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Great Rift Valley Lodge
NAIVASHA, KENYA

Transforming Potato and **Sweetpotato Value Chains** for **Food** and **Nutrition Security**

Book of abstracts

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Acknowledgement

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Travel Guide

(Sourced from Charleston Travel Ltd and FCm Travel Solutions)

KENYA

No other country on earth can offer the visitor as much to see and do. Within the borders of a single country, you will find savannahs rich with big game, timeless cultures unchanged by the modern world, pristine beaches and coral reef, equatorial forests and mighty snow-capped mountains, searing deserts and cool highland retreats and endless opportunities for adventure, discovery, relaxation; more than you would ever expect.

Kenya lies astride the equator on the eastern coast of Africa. It is a medium-sized country by continental standards; covering an area of about 586,600km sq. Inland water bodies cover some 10,700km sq. the bulk of this in Lakes Victoria and Turkana.

Kenya has tremendous topographical diversity, including glaciated mountains with snow-capped peaks, the Rift Valley with its scarps and volcanoes, ancient granitic hills, flat desert landscapes and coral reefs and islets.

GEOGRAPHY

Land Area: 582,650 square kilometers
Land Size: 569,250 sq km
Water Size: 13,400 sq km
Location: Lies astride the equator on the eastern coast of Africa.
Capital: Nairobi
Rainfall: Mid-March to May (Long rains) and October to November (Short Rains)
A/Temp: It varies from tropical humidity of the coast, the dry heat of the savannah or semi-arid areas and the cool air of the highlands. Temperatures in these areas are fairly constant year round with an average of 27°C (80°F) at the coast, 21°C to 32°C (70°F to 90°F) in the hinterland, while in Nairobi and the highlands over 5,000 ft., the daytime temperatures normally range between 19°C and 24°C (66°F to 75°F).

Mombasa (coastal): Max 30ºC, Min 22ºC

Nairobi: Max 25ºC, Min 13ºC North Plain lands: Max 34ºC, Min 23ºC

Altitude: High-attitude areas (over c. 1,500 m) in the central Kenya highlands usually have substantial rainfall, reaching over 2,000 mm per year in parts of the Mau Escarpment.1, 524 m and 300 miles inland.

Terrain: Low plains rise to central highlands bisected by Great Rift Valley; fertile plateau in west

Vegetation: Tropical rainforest the shores of Lake Victoria, the savannah in the Rift Valley and Highlands, and the north and northeast are sparse and primarily consist of thorn bush.

Land use: Arable land: 8.08% permanent crops: 0.98% other: 90.94%
N/Resources: Soda Ash, Salt, Fluorspar, Limestone, Zinc, Diatomite, Gemstones, Gypsum, Hydropower, Gold.

Exports: Tea, Flowers, Fruit, Coffee, Cement, and Vegetables.

Rivers: Athi/ Galana which empties into the Indian Ocean, and Tana which hits the coast between Lamu and Mali

Kenyan Main Industries: Small-scale consumer goods (plastic, furniture, batteries, textiles, clothing, soap, cigarettes, flour), agricultural products, horticulture, oil refining, aluminum Industries, steel Industries, lead Industries, cement Industries, commercial ship repair

National Parks and Reserves

Nairobi National Park
Abadare National Park
Amboseli National Park
Lake Nakuru National Park
Tsavo National Park
Meru National Park
Marsabit National Park and Reserve

Money

The unit of currency is the Kenyan shilling (Ksh), which is made up of

Notes (in circulation are)	**Coins (in circulation are)**
Ksh 1000	Ksh 40
Ksh 500	Ksh 20
Ksh 200	Ksh 10
Ksh 100	Ksh 5
Ksh 50	Ksh 1

Most major currencies are accepted in Kenya. Traveler's cheques are also more widely accepted. The Best places to change money are Forex Bureaus which are found everywhere in Kenya. Kenya has no black market for foreign currency. Changing money on the streets should be avoided.

International transfers are possible through Western Union Money Transfer or directly through Banks.

Credit cards are in wide use with several ATM machines covering most major Towns. Standard Chartered ATMs take Visa cards. Barclays bank ATMs supports Master Card, Visa, Plus and Cirrus International Networks.

NAIROBI

Nairobi is the capital and largest city of Kenya. The city and its surrounding area also form the Nairobi City County. The name ***"Nairobi"*** comes from the Maasai phrase ***Enkare Nyrobi***, which translates to ***"cold water".*** The phrase is also the Maasai name of the Nairobi River, which in turn lent its name to the city. The pleasant climate and green leafy neighborhoods surrounded by virgin plains of savannah gave it the name

"Green City in the Sun" and is surrounded by several expanding villa suburbs. Founded by the British in 1899 as a simple rail depot on the railway linking Mombasa to Uganda, the town quickly grew to become the capital of British East Africa in 1907, and eventually the capital of a free Kenyan republic in 1963. The city lies on the Nairobi River, in the south of the nation and has an elevation of 1795 m above sea-level.

VIEW POINT

The best point to view the Great Rift Valley is from the ***view point*** situated along the Nairobi Nakuru Highway.The **Great Rift Valley** is a large trench that runs through Kenya from north to south. It is part of the *Gregory Rift*, the eastern branch of the East African Rift, which starts in Tanzania to the south and continues northward into Ethiopia. In the past, it was seen as part of a "Great Rift Valley" that ran from Madagascar to Syria. Most of the valley falls within the Rift Valley Province. The site is breath taking I hope it leaves a part of Kenya forever imprinted in your heart.

NAIVASHA

Naivasha is a small town located about 70 km. North West of Nairobi, and sits on the floor of the Great Rift Valley. Naivasha Constituency covers an area of about 2,300 sq. km and has a population of about 400,000 people. It is a busy and popular transit point for the movement of goods and services as it's located on the route of the Uganda Railway and Highway between Nairobi and Nakuru and a favorite stop for people to get refreshments as they head upcountry. Naivasha is also a preferred retreat for Nairobi residents looking for

peace and tranquility. Some of the main attractions that draw visitors to Naivasha is Mt. Longonot, the majestic 11,000 ft. dormant volcano, Hells Gate National Park, and Lake Naivasha, which is rich in bird life, with over 400 different species, and a variety of wild life and marine species.

The main economic activity in Naivasha is agriculture. Wheat, dairy, pyrethrum, grapes, maize, potatoes, onions, cabbages, carrots, etc. thrive in the fertile volcanic soils. This agricultural activity is rain fed, so when the rains fail, so do the crops, leading to shortages of staple foods. The most vibrant and fastest growing commercial activity is carried out by the large multinational owned flower and horticulture farms nestled along the shores of Lake Naivasha.

Lake Naivasha

Is a beautiful freshwater lake, fringed by thick papyrus. The lake is almost 13kms across, but its waters are shallow with an average depth of five metres. Lake area varies greatly according to rainfall, with an average range between 114 and 991 sq kms. At the beginning of the 20th Century, Naivasha completely dried up and effectively disappeared. The resulting open land was farmed, until heavy rains a few years later caused the lake to return to existence, swallowing up the newly established estates. Afternoon wind and storms can cause the Lake to become suddenly rough and produce high waves. For this reason, the local Maasai christened the lake **Nai'posha** meaning **"rough water",** which the British later misspelt as **Naivasha...**

The lake and its surrounds are rich in natural bounty, and the fertile soils and water supply have made this one of Kenya's prime agricultural regions. Much of the lake is surrounded by forests of the yellow barked ***Acacia Xanthophlea,*** known as the yellow fever tree. These forests abound with bird life, and Naivasha is known as a world class birding destination.

The waters of the lake draw a great range of game to these shores. Giraffes wander among the acacia, Buffalo wallow in the swamps and Colobus monkeys call from the treetops while the Lakes large hippo population sleeps the day out in the shallows. The region surrounding the Lake is well worth exploring. There are two smaller lakes nearby, ***Oloidien***, and ***Sonachi***, a bright green crater lake.

Great Rift Valley Lodge From its panoramic perch above Lake Naivasha, the Great Rift Valley Lodge enjoys one of humankind's oldest views – over the sweeping floor of the world's largest valley.
Location

An hour and a half's drive or a 30-minute flight from Nairobi (24 kilometers from Naivasha town and 12 off the Nairobi-Nakuru highway), the Lodge is built on the ***Eburru,*** a mountain that the Maasai call ***Ol Donyo Opurru***, meaning **"mountain of smoke"**.

The lodge sits at about 7,000 feet, from which elevation it enjoys magnificent views to the west and east. The vistas stretch from the sparkling waters of Lake Naivasha to the

the jagged volcanic crater of Mount Longonot and, beyond, the sloping shoulders of the Aberdare Mountains – Kenya's most important watershed.
The Great Rift Valley Lodge has also been awarded the Trip Advisor Certificate of Excellence. The accolade, which honors hospitality excellence, is given only to establishments that consistently achieve outstanding traveller reviews on Trip Advisor, and is extended to qualifying businesses worldwide.

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Kericho County

Kericho is a Kenyan County located in the south-west of the country, located within the highlands west of The Kenyan Rift Valley. The capital of the county is Kericho town. The district is home to the best of Kenyan tea, known for its brightness, attractive color, brisk flavor and textures of fragrant leaves. The county is also home to some of the world's best long distance runners, many having won gold medals in international events.

Kericho is home to Kenya's biggest water catchment area, the Mau Forest. With a high altitude and virtually daily rain. The Temperatures range from a minimum of 16°C to a maximum of 20°C. The average rainfall ranges between 1,400 mm and 2,000mm per annum.

Kericho is the centre of Kenya's large tea industry, and its town square is even known as ***Chai Square*** (Chai is Hindi for Tea). Some of the largest tea companies including Unilever Kenya, James Finlay and Williamson tea are based here. It is also home to the popular Ketepa brand. Much of the tea is exported, with the UK being the largest market. The town has an urban population of 150,000 and a total population of over 500,000


Other attractions of Kericho are, Natural resources as Mau Forest, Arable land, Water, Diary Livestock Farming, Horticulture and Floriculture, Wheat, Fish Farming and Tourist attractions as Monkey Sanctuary, Bird Watching, Chagic Botanic Garden

Bungoma

Bungoma is a town in the Western Province of Kenya, bordered by Uganda in the west. Bungoma town was established as a trading centre in the early 20th century. The town is the headquarters of Kenya's Bungoma District and it hosts a municipal council. Farming is the main economic activity in the province. Bungoma district is sugar smallholder with one of the country's largest sugar factories, as well as numerous mills. Maize is also grown for subsistence, alongside pearl millet and sorghum. Dairy farming is widely practiced, as well as the raising of poultry. The area experiences high rainfall throughout the year, and is home to several large rivers, which are used for small-scale irrigation. There is a small but important tourist circuit, centering on the biennial circumcision ceremonies.


Main Economic Activities include Webuye Pan Paper Mills, Nzoia Sugar Factory, BAT Malakisi and Mastermind, commercial businesses, Sugarcane Farming, Livestock farming

Kisumu County

Kisumu County is one of the new devolved counties of Kenya. Its borders follow those of the original Kisumu District, one of the former administrative districts of Nyanza Province in western Kenya. Its headquarters is Kisumu City. It has a population of 968,909 (according to the 2009 National Census). The land area of Kisumu County totals 2085.9 km².The names Kisumu comes from the Luo word ***"Kisuma"***. Generally, Kisuma means "a place where people meet to exchange goods" The word originally comes from the verb "sumo", which means "getting the left-overs from a farm after the harvest". When Europeans and Indians came to the area of the present-day city of Kisumu, pronouncing the name "Kisuma" correctly proved difficult, and the name evolved into the current Kisumu.

Fishing, Agriculture, Industry, Services

Kisumu County sits on the shores of Lake Victoria, providing it with the potential to be a major centre of fishing. However, the use of old technologies hampers the full development of the industry. Also, the recent water hyacinth menace on the lake has reduced fish catches significantly.

Rice is grown under irrigation in the Kano Plains. Most of the water for irrigation comes from River Nyando, whose annual floods displaces huge numbers of people but also deposit a lot of fertile silt all across the plain. The northern and eastern fringes of the Kano Plains also play host to some of Kenya's most productive sugarcane fields. Towns like Kibos, Miwani and Chemelil are centers of sugarcane production. Kisumu County also produces maize, beans, ***SWEET POTATOES***, poultry and fresh vegetables.

Kisumu city and the surrounding areas have several light industries. These include textiles, molasses, fish processing plants and agricultural produce processors. Kisumu city is the major commercial centre in Western Kenya. Service industries like wholesale & retail trade, bicycle repair, car repair, entertainment centers and low scale IT services abound within and outside the city.



Nyeri County

Nyeri is a town in situated in the Central Highlands of Kenya, it is about 150km north of Kenya's capital Nairobi and it was the administrative headquarters of the country's former Central Province. Following the dissolution of the former provinces by Kenya's new constitution in August 26, 2010, Nyeri is now the largest town in the newly created Nyeri County.

The town is situated about 150 km (a two-hour drive) north of Kenya's capital Nairobi, in the country's densely populated and fertile Central Highlands, lying between the eastern base of the Aberdare *(Nyandarua)* Range, which forms part of the eastern end of the Great Rift Valley, and the Western slopes of Mount Kenya.

The town's population as at 2010 according to the 2009 Kenya Population and Housing Census was 119,273 with 36,412 households. Nyeri's Town Centre is small. Its general appearance, owing mostly to a lack of footpath paving and the basic decoration of its buildings, is dusty and old, though there are some new construction developments and building renovations. While small business activities are vibrant, Nyeri is essentially a government administration town.

The town has a relatively low cost of living in comparison to Nairobi and other major towns in Kenya. Located in Kenya's fertile highlands, food and water are plentiful. Nyeri is a popular destination for relaxation, business, entertainment, and educational/cultural tourism. Its pubs offer lively entertainment, the farms in and around it offer pristine scenery, and the grave of the scouting Movement's founder, **Lieutenant-General Lord Baden-Powell**. He and his wife, **Olave, Lady Baden-Powell**, are buried in the town cemetery, and his cottage, called

Paxtu now a small museum; stands on the grounds of The Outspan Hotel is a popular attraction. The ***Italian War Memorial Chapel***, located at Mathari, was built in honour of the fallen Italian soldiers and their African recruits from the Second World War

Natural resources as forests, wildlife, minerals (stone, sand, Kaolin), livestock, pasture, water, medicinal plants. Tourist Attractions as Mt. Kenya, Mt. Kenya National Park, Aberdare National Park and its main economic activities include Tea Coffee, Dairy Farming, Milk Processing Farms and Maize Millers

Nakuru County

Nakuru County Council is one of the largest counties in the Republic of Kenya, East Africa. It's the former provincial capital of Kenya's Rift Valley province. It is home to a population of around 1.6 million, living on some 5,000 square kilometers in the central part of the country. Located in the south eastern part of the Rift Valley Province and borders 7 counties with Baringo to the north, Laikipia to the north east, Nyandarua to the east, Kajiado to the south, Narok to the south west with Bomet and Kericho to the west with Temperatures ranging from a minimum of between 12°C to a maximum of 26°C. Rainfall ranges from 1800mm to 2000mm per annum with the wettest season during April and May. Nakuru has always been one of the wealthiest regions in Kenya and has a huge agricultural, transportation and tourism potential. Sitting at the base of the Great Rift Valley, the county possesses one of the richest array of Kenya's tourist attractions.

Keynote Abstracts

Strategies to improve poor seed potato quality and supply in sub-Saharan Africa: Experience from interventions in five countries

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Abstract

Potato yields in sub-Saharan Africa are very low with 6-10 tha^{-1}. Potato yields of small-scale farmers in the region fall far short of their potential due mostly to a potent combination of inadequate supplies of high-quality seed and smallholders' limited awareness of better seed management practices. Currently the formal seed system supply is typically less than 1% of the respective country's demand and on-farm management of seed borne diseases is rarely implemented by small-scale farmers as knowledge of seed borne diseases is generally poor. Viruses and other seed borne diseases can cause severe seed degeneration leading to decrease in yield, quality and economic losses. Viral infections in particular, PVY and PLRV, and bacterial wilt (*Ralstonia solanacearum*) are the main diseases affecting seed quality in the region. To increase the availability of high grade potato seed, CIP, together with its national partners, has developed components of an innovative seed strategy, named "The 3 seed potato generation revolution" (3G), which both dramatically lowers the cost of production of pre-basic or "starter" seed coupled with extension based interventions to train smallholders in better on-farm management of their own seed. The "3G" seed strategy envisages producing large numbers of minitubers through one generation of a very rapid multiplication technology (RMT), with technologies like in-vitro multiplication and minituber production using aeroponics and hydroponics; thus allowing bulking of sufficient seed in only 2 field generations rather than the conventional 4 to 6 generations. This reduces both the cost of production and prevents the buildup of damaging diseases in the field. Greater involvement by the private sector in seed potato value chains offers a means to overcome the supply bottleneck that is limiting the provision of quality seed. A more efficient and responsive seed system will improve production, distribution, use, and profitability for farmers. Promising rapid multiplication technologies, the "3G revolution," and an engaged private sector can provide needed capacity to broaden adoption of quality seed and accelerate availability of new varieties with more prospect of added value. Better integration of national agricultural research and extension systems into the value chain, as well as farmer training schemes in seed management and storage, can accelerate innovation. A regional perspective can help exploit economies of scale for sharing knowledge and technology, implement creative applications of information communication technologies, advocate for farmer-friendly seed-related regulations and policies, improve the business enabling environment, and expand intra-regional trade for seed of the highest categories. Recent and ongoing interventions reveal that a wide-scale adoption of these technologies, as well as increasing farmers capacity in disease management and storage, would be an appropriate response to current concerns over rising food prices, help to secure seed supplies for the next few seasons and to put the whole seed supply chain onto a more sustainable path for the future. The presented paper gives an overview and comparative analysis of costs and benefits from experiences from seed interventions from Ethiopia, Kenya, Malawi, Rwanda and Uganda from the past five years.

Keywords: Potato, sub-Saharan Africa, "3G seed potato revolution", rapid multiplication technologies

The role of the private sector, public private partnerships and intellectual property management in technology transfer

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Abstract

Private sector providers now account for more than half the quality certified potato seed produced in Kenya and directly and indirectly supply an estimated 14- 20,000 small-holder farmers annually. A key Kenyan seed multiplier, Kisima Farm in Timau, regularly supplies seed of four public bred varieties and constitutes a private sector initiative which arose from a public private partnership (PPP) between this private partner and the International Potato Center (CIP), KARI, KEPHIS and the Kenyan Ministry of Agriculture. Variety innovation is key to the further development of the potato sector in Kenya and in particular opening the important fast growing processing sector to participation by small-holder producers as well as introducing important new traits such as heat tolerance. A recent partnership between Kisima Farm and a European potato breeder (HZPC) will permit the local production of important new processing varieties in Kenya under licensing terms which favor small-holder access to the seed. The paper will describe how tools such as Intellectual Property Rights (IPR) management can facilitate the entry of the private sector to invest in the multiplication and dissemination of quality seed of new varieties from both public and private sector breeders.

Advances in sweetpotato breeding from 1992 to 2012

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Sweetpotato, with a global annual planting area of approximately 9 million ha is the second most important tropical staple root crop. It requires a short crop season, true seed set is easily obtained, generation cycles are short and it is hard in nature and broad in usability. The wide adaptation of the crop holds true for environments (i.e. sweetpotato is grown in more than 110 countries of the world), the range of nutrient contents in roots and leaves, extremes in consumer needs such as non-sweet taste, as well as the possibilities in processing such as animal feed, starch, flour, candy, alcohol and biofuel. There are seven objectives of this review. The first is to describe the development of production, annual planting area and yield from 1992 to 2012 in West-, East- and Southern Africa, South Asia, East and South East Asia, the Pacific and China. The second objective describes new knowledge obtained about the ancestors and the genetic structure of sweetpotato. The third objective is to provide an overview of programs breeding sweetpotato for more than 20 years and those which started to breed sweetpotato during the last 20 years. The fourth objective is to inform the audience about traditional breeding objectives and new breeding objectives which have evolved during the past 20 years by regions. The fifth objective is to provide information about breeding methods, including how farmers still breed sweetpotato,

generation of simple true seed by breeders, polycross seed nurseries, controlled cross breeding and number and size of crosses, and recent approaches to systematically exploit heterosis in sweetpotato breeding. The sixth objective is to provide an overview and new guidelines for the allocation of breeding resources in early and later selection stages. The seventh objective is to provide information about new variety releases during the past 20 years in West-, East- and Southern Africa, South Asia, East and South East Asia, the Pacific and China.

Was small ever beautiful? Moving local sweetpotato seed systems to scale in sub-Saharan Africa

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Abstract

In sub-Saharan Africa, a range of farmer-based practices for the conservation and multiplication of sweetpotato planting material have evolved. In bi-modal rainfall areas, sequential planting ensures that a ware crop is in the ground for most of the year, and vines are harvested from one crop to plant the next one. In uni-modal areas with a long dry season, practices include the use of "volunteer" planting material from sprouting roots which have been left in the ground from the previous crop. The predominant sources of planting material are from the farmer's own field or from friends or neighbours. However, these practices result in limited amounts of planting material being available at the start of the rains and contribute to the build-up of pests and diseases which in turn lead to sub-optimal root crop production. Sweetpotato breeding efforts are leading to the development of new varieties preferred by farmers and consumers. However without strong linkages to seed multiplication and dissemination efforts these varieties may not quickly benefit large numbers of small-holder farmers and consumers. Increasingly there are specialised vine multipliers who have been supported by "project" interventions. Yet, it is not clear whether and how these interventions have built on the successful elements of existing practices. Our paper examines the literature on local seed system functioning, and the implications for crops such as sweetpotato. The paper reviews recent efforts to multiply and disseminate sweetpotato planting material in Mozambique, Uganda, Tanzania, Malawi, Ethiopia and West Africa. New varieties and technologies have been promoted together with interventions to "engineer" changes in the organization and coordination of the seed system. We review the country cases to gauge the extent to which successful elements of farmer-based practices for managing sweetpotato planting material have been identified and built into the process of re–designing the seed system. A number of issues are identified for discussion. These include: what are the critical points for interaction between the traditional farmer based practices and the formal seed system; what are the trade-offs between: remaining local, and yet achieving scale; and how can the quality of planting material be assured as we go to scale. We also assess the different drivers for the seed system, and the implications for the functions of various stakeholders and patterns of communication and coordination. The paper concludes by highlighting gaps in our current understanding for getting sweetpotato seed systems not only moving, but working at scale.

A paradigm shift in potato and sweetpotato research- adopting the agricultural products value chain (APVC) approach in Kenya

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Abstract
Many countries in Africa have not exploited the full potential of their agricultural sectors. This is in part due to failure by these countries to add value to their agricultural sectors including the potato and sweetpotato subsectors through agro-processing and vertical integration. The challenge to research is therefore to determine and address the main causes that prevent the implementation of the profitable components (value-adding and processing) of potato and sweetpotato product value chains from taking place within the rural areas. In Kenya, the potato and sweetpotato programmes like other research programmes implemented by the Kenya Agricultural Research Institute (KARI) have recently adopted the Agricultural Product Value Chain (APVC) approach to agricultural research for development- thus taking a paradigm shift from previously used approaches in research. The APVC concept describes the full range of activities required to bring a product or service from conception through the full range of products, involving a combination of physical transformation and inputs of various producer services, delivery to final consumers and disposal after use. The approach borrows instruments from various concepts of economic promotion and provides a framework for analyzing institutional, technical and social constraints. The APVC approach as implemented in potato and sweetpotato research permits analysis of the whole product systems which facilitates the identification and prioritization of opportunities and problems throughout the systems leading to the development of a more realistic research agenda. Identification of APVC-based research agenda begins with a comprehensive overview of the target APVC. The starting point for research design is the identification of market opportunities for given potato and sweetpotato products. Then, if the opportunities are not fully exploited, the next step should be a thorough assessment of: (i) The system required to deliver the product, identifying the principal components of the system and major participants and their roles. (ii) The priority problems within each component of APVC and their causal relationships. (iii) Possible solutions to the problems and their order of priority. and (iv) The necessary interventions to solve the problems, starting with the most binding. The APVCs research is characterized by increased vertical coordination from resource management, production, post-harvest processing, marketing and interaction with consumers. This demands more integration and coordination of all research service-providers around priority APVC-based research projects while paying more attention to post-harvest and value-addition processing as well as the development and marketing of potato and sweetpotato products, by-products and services. Successful application of agricultural product value chain approach to potato and sweetpotato research requires a very complex system that brings together many players. The research to support such a system needs to be organized in such a way that it can add value to the system. This therefore, calls for creation of a mechanism for establishing flexible alliance frameworks that would allow different KARI centres or KARI centres and other organizations, including the private sector, to form temporary APVC teams to solve particular problems within a specified time. The formation of such temporary APVC teams ensures the availability of a critical mass of scientists with the right disciplinary mix to provide multidisciplinary solutions for priority problems.

Key words: Agricultural Products Value Chain, Kenya Agricultural Research Institute, paradigm shift, potato and sweetpotato programmes.

Disease management, especially viruses in potato and sweetpotato

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Abstract
Potato (*Solanum tuberosum*) and sweetpotato (*Ipomoea batatas*) are the 4th and 7th most important crop plants globally. Both are important subsistence crops in East Africa and complement each other since their growth requirements differ. Potato and sweetpotato are vegetatively propagated, making them prone to accumulation of viruses during cultivation, and ca. 40 and 30 viruses have been reported to infect them, respectively. In East Africa, viruses comprise the only significant disease agents in sweetpotato. The most severe yield losses are caused by dual infection of plants with *Sweetpotato chlorotic stunt virus* (SPCSV, crinivirus) and other, unrelated viruses, because the RNase3 protein produced by SPCSV eliminates antiviral defence. Therefore, control of SPCSV is of outmost importance in the control of virus diseases in sweetpotato. Recent surveys have also highlighted the prevalence of begomoviruses in sweetpotato throughout Africa; significant yield losses have been reported even in symptomless single infection. In potato, *Potato leaf roll virus* (PLRV, polerovirus) and *Potato virus Y* (PVY, potyvirus) are the most widely spread and damaging viruses in potato crops. In Eastern Africa, closer knowledge on viruses affecting potato crops is relatively limited, but some recent data are available from Kenya and Tanzania. Healthy seed potatoes and sweetpotato vine cuttings available for planting are a prerequisite for successful production. Knowledge on resistance to the local viruses and virus strains is another important issue when choosing cultivars for production. Antibodies to the most common potato viruses are commercially available and their use for indexing seed potatoes is straight-forward with the basic diagnostic capacity. In contrast, antibodies to sweetpotato viruses are commercially unavailable. Analysis of the small RNA molecules (siRNA) resulting from degradation of viral genomes by RNA silencing, the basal antiviral defence mechanism of plants, provides a universal, novel method for detection of plant viruses and does not require advance knowledge of them. It is promising for indexing of the stock plants used for further propagation of planting material. The technology is also applied to the identification of novel viruses and analysis of virus variability throughout Africa, which will inform development of novel control methods and testing regimes to control the most harmful viruses for each region.

On the road to potato processing in African tropical highlands

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Abstract

Potato processing at the industrial level is relatively insignificant in the tropical highlands of Africa such as in Ethiopia, Kenya, Uganda and Rwanda. No large international companies are present in this area whereas they have successfully established themselves in North Africa (Egypt) and South Africa. The reason for the presence of large French fries (chips) and crisps factories in North and South is the availability of growers who have relatively large areas of irrigated land assuring a year-round flow of raw material with the required specification and consistency for the finished product. The objectives of recently carried out investigations in Rwanda and Ethiopia funded by the Netherlands government were to investigate the challenges and opportunities for the establishment of (private) industrial processing facilities. Processing into finished products includes the supply chain of graded, washed, packed and branded ware potatoes for high(er) end supermarkets. Such factories and installations would create added value through employment in the whole supply chain from breeding new varieties, creating a supply chain of seed and ware (raw material) potatoes, post-harvest handling, processing and trade. The study in Rwanda and Ethiopia consisted of the following elements: a quick scan of potato production related to potential supply of raw material to the industry, an inventory of current processing at household and restaurant level such as boiling, mashing, and the preparation of fries and chips; an inventory of the current availability of processed potato products such as frozen French fries, chips and mashed potato powder and packed fresh tubers at markets and supermarkets. An estimate was made of the current and future market for these products. For French fries two options exist: peeling, cutting, frying and freezing (deep-frozen storable for months) or chilling after frying and consumed within a few days. The type of small and medium equipment needed and their costs was assessed. Using historical meteorological data and a crop growth model calculated attainable yields and water use in the two countries which was used for yield gap analyses. From this and from farm surveys the costs and competitiveness of the raw material were derived and from it conclusions regarding the costs of locally produced versus imported finished products. From the work we did we conclude that the farm gate potato price – related to cost of production is quite competitive in Ethiopia - about halve of that of northern Europe in Ethiopia and about equal to North western Europe in Rwanda – which is most important to be competitive with imports in future. Currently an investor plans a frozen chips (French fry) factory in Ethiopia to open in 2014. In Rwanda a similar action is planned with government involvement.

Improvement of processing technology research and utilization of Sweetpotato and its derived foods

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Abstract

New research on emerging processing technologies of sweetpotato flour and puree using roots rich in Vitamin A and anthocyanin shows that there is great potential to commercialize the crop. The paper is in two parts, the first part describes some of these new technologies such as accurate gelatinization with microwave, continuous separation, energy saving drying and high hygiene packaging for sweetpotato flour and puree. Additionally a description of these technologies and their utilization is provided. Part one of the paper also describes new improved machines and how they work to make nutritious healthy foods such as baked bread, cookies, biscuits, instant flour, snack foods and table foods by means of the flour and puree, from fresh roots. The successful technology research and agro-industry processing practice for starch and its derived cooking and instant noodle in Sichuan, China has been discussed. The second part of the paper looks at the results of the recents sweetpotato processing work using puree done in Rwanda. Here evidence is shown from research done on commercial products that are already in the market and indicates that consumers prefer products made from a mixture of Orange Flesh Sweetpotato (OFSP) puree and wheat flour compared to the normal wheat based products of product using OFSP flour and wheat flour.

Key Words sweetpotato, flour, puree, starch, energy saving drying, microwave, consumer sensory tests

Addressing the changing consumer behaviour in the South African market

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Potatoes South Africa

Abstract

South Africa's eleven official languages are indicative of its diverse consumer profile and its subsequent distinctive eating habits. Contributing to this complexity is the rapidly changing consumer behaviour as well as a constant influx of new consumers, especially from other African countries. Consumer behavioural changes can be measured by the South African Research Foundation's class mobility figures. These figures indicate the growth and behaviour of the middle-income population of South Africa. This middle target group, which is specified by the Life Style Measure 4 - 7 (LSM 4-7), represents 61.2% of the total population and therefore is the main target market for the potato industry's marketing and promotion activities. The main challenge for the potato industry is to successfully address and satisfy this complex consumer market. In order to achieve this, Potatoes South Africa utilises its own research, as well as other available information on consumer behaviour to develop an integrated promotion campaign. The target market can be divided into various segments such as youth (school programmes), chefs, sport, media, retail (formal and informal), etc. Following the identification of the segments, relevant information (e.g. nutritional value and cultivar classification of potatoes) can be successfully marketed and communicated to the respective groups through various campaigns. At present, Potatoes South Africa is involved in continuous research regarding classification of different cultivars

based on their cooking and processing quality groups. This research will assist us to focus our marketing approaches of different potato cultivar groups to specific target groups. An important factor to bear in mind is that, as the consumers become more knowledgeable about a product, they become more demanding and develop a constant need for more information. As an industry we need to acknowledge, appreciate and stimulate this need to increase awareness of the product which in return will result in increased sales and growth of the industry.

Assessing nutritional value and changing behaviors regarding orange-fleshed sweetpotato use in sub-Saharan Africa

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Abstract

During the past 15 years, significant investments have been made in the development and promotion of orange-fleshed sweetpotato varieties (OFSP) in sub-Saharan Africa (SSA) due to their high beta-carotene contents and thus, their potential to contribute towards reducing vitamin A deficiency. As the dominant varieties in SSA are white-fleshed, lacking in beta-carotene, the introduction of OFSP means that producers and consumers need to accept the very visible change in color along with any other trait differences. We first review the building of the evidence base for OFSP in SSA, summarizing the key lessons learned to date, focusing on interventions aiming for impact on vitamin A intakes or status. Second, we review the state of knowledge concerning the how to maximize the nutritional value of OFSP when processed and identify appropriate entry points to reach rural and urban consumers. Third, we explore how the health sector and private sector marketing firms are tackling behavioral change and based on this accumulated multi-sector experience develop improved recommendations to guide practitioners on how they should approach reaching consumers. Finally, we pinpoint opportunities to enable the successful scaling out of OFSP adoption and utilization and identify needed areas of research to address remaining knowledge gaps. In developing OFSP-focused food-based approaches, several key questions are addressed: 1) Are OFSP varieties competitive with existing local varieties? 2) Do producers and consumers accept a variety with a distinct color difference? 3) What does it take to get proper utilization of OFSP at the household and the young child level? 4) What are the key nutrition messages? and 5) What do we need to do to break into rural and urban markets? We also examine the best techniques for assessing micronutrient contents of OFSP and its impact on status, the minimum amount of fat consumption linked to OFSP consumption and the bioaccessibility of OFSP processed in different ways. After reviewing how other sectors are approaching behavioral change, we propose 12 key recommendations on how to approach rural households and present dominant factors likely to influence urban consumer behavior. The current policy environment is very favorable to integrated agriculture-nutrition interventions, and the Scaling-up Nutrition (SUN) movement emerges as the most promising opportunity for OFSP integration.

Abstracts

Theme One

Appropriate policies for germplasm exchange, food security and trade in Africa

TH1ABS221

Analysis of the value chain of sweetpotato and household food security in Southern Benin

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Abstract

Sweetpotato is one of the root and tuber crops that can adapt and grow in various agro-ecological conditions. From a nutritional standpoint, it is an important source of food energy and so contributes to the high human and animal nutrition, and thus food security in many parts of the world. In Benin, its production has been increasing in recent years. The present study aims to promote a value chain of sweetpotato through economic analysis, to identify its place in the food sector and analyze the level of household food security of farmers surveyed. To achieve this goal, data were collected in the townships of Dangbo, Athiémé, Pobè and Klouékanmè belonging to the three agro-ecological zones that make up the Southern Benin and market Ouando of Porto-Novo. Interview guides and structured questionnaires were conducted with 177 participants (farmers, collectors, wholesalers, retailers). Economic analysis, test prioritization K Kendall and frequency analyzes were used to analyze the data.The analysis of these data showed the existence of two (02) value chains of sweetpotato: the value chain of raw sweetpotato for the local market and the value chain of raw sweetpotato to the under-regional market. Value chain of raw sweetpotato for the local market (chain studied) generated revenue of 57.87 FCFA / kg for all the links with participation in the creation of revenue estimated at 42.73% for producers, 11.49% for the collector, 36% for wholesalers and 9.78% for retailers. In addition, analysis of the results showed that the sweetpotato doesn't have a privileged place in the daily diet of the respondents. It was ranked in the fifth position after maize, cowpea, cassava and rice. Finally, the analysis of the level of household food security of farmers indicated the likelihood of food insecurity. This was the case for nearly 40% of respondents and 12.5% of whom seemed to be affected by chronic food insecurity. In order to reduce malnutrition in the population, we should increase investment in research to improve the products promoted in order to make them comparable to cassava products.

Keywords: Value chain, Sweetpotato, Value added, Food Security, West Africa.

TH1ABS032

Ex-ante evaluation of improved potato varieties for Sub-Saharan Africa

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Abstract

In many parts of Sub-Saharan Africa, potato plays an important role as a food security crop. Yet, technological improvements to boost potato productivity have so far not been extensively utilized. Moreover, it remains unclear which potential impacts can be expected from future technological innovations in potato production in the region. To shed light on this question, a scenario of the development and diffusion of improved potato varieties for nine countries in Eastern and Central Africa is developed and assessed. The scenario involves varieties which combine a number of improvements in pro-poor, productivity enhancing traits and is analysed using an economic partial equilibrium model of the world agricultural sector. Taking into account spill over effects across markets and countries, the analysis finds positive net welfare effects at the global level, ranging from 60 m US$ to 403 m US$. Global returns on investment are positive between 20% and 37%. Effects of the intervention on potato supply in the target countries range from 0.5% to 8.5%. Potato producers in these countries are found to benefit, but producers of other commodities and in other countries beyond the region are negatively affected. Lower market prices for potatoes and other commodities lead to welfare gains to consumers worldwide and in the region. At the level of the target countries, the improved potato varieties are found to generate returns on investment between 20% and over 70%, depending mainly on the level of adoption. The analysis shows that investing in crop improvement and variety development for Sub-Saharan Africa can be a worthwhile undertaking with returns that easily justify intervention. However, it also highlights the importance of variety diffusion for the intra-regional distribution and the magnitude of the impacts and suggests putting emphasis in seed systems development to promote quick dissemination and high adoption levels.

TH1ABS123

Identifying factors that determine potato varietal adoption at the farmer level in East Africa: emphasis on Ethiopia

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Abstract

Several reports have shown that potato productivity in East Africa, and especially in Ethiopia, is declining through time due mainly to abiotic and biotic stresses. Adoption of improved varieties could help reverse the decline. A coordinated potato research program in Ethiopia was started in 1975 with the objective of developing high yielding and late blight resistant potato varieties. Since then, the Ethiopian research system has released more than 25 new potato varieties and efforts have been taken to disseminate these to growers.

However, most of these improved varieties have not remained in production, while the local cultivars continue to be grown and still cover approximately 98.7% of the total potato growing area. To determine the reasons for the low adoption rate, a survey was conducted in five major potato producing districts of Ethiopia in 2012 with the objective of identifying factors that influence farmers' decision in adopting and abandoning potato varieties. The areas surveyed were LaiGaint, YilmanaDensa, Quarit, Banja and Shashemene, which represent different agro-ecologies and production systems. The results indicated that in each survey district, the selection criteria of farmers varied widely based on cropping systems, market preference traits, storage duration of the varieties, available resources and climate change issues. The varieties that farmers grow differ across regions and have desirable qualities in relation to taste, storage quality, adaptation to drought, poor soil fertility and agro-ecological fit. With the exception of Quarit, all of the interviewed farmers were aware of new released varieties, either directly or indirectly. The reasons to why new varieties were not adopted varied across the districts. Clearly, potato breeding strategy should pay attention to farmers' resources and real needs. Utilizing desirable, locally-adapted cultivars as parents in the Ethiopian breeding program would likely increase the adoption of new cultivars going forward.

Key words: Potato, local varieties, released varieties, varietal adoption, Ethiopia

TH1ABS035

Market structure and price: an empirical analysis of Irish potato markets in Kenya

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Abstract
In many developing countries such as Kenya, food markets are characterized by information asymmetry, inadequate storage and transport infrastructure and poor physical and institutional organization. The study examines the trends of domestic prices of ware Irish potatoes in production markets Nakuru and Eldoret and consumption markets Nairobi and Mombasa and investigates the relationship between market structure and prices of Irish potatoes in the different markets. Market performance, price transmission and market integration were measured using monthly data from January 1998 to May 2011. The results show that, there is a general rise in the nominal price of potatoes, the farm-gate share of wholesale market prices for ware Irish potato have increased between 2009 and 2010 from 35 percent to 52 percent in Nakuru and the same increase is reflected in Eldoret. In addition, the percent shares suggest that there exist large marketing margins that are accrued by middlemen/ brokers who are active actors in the marketing chain. Potato markets are oligopolistic in nature i.e. there are few market participants in the form of rural brokers, urban brokers and transporters who have the market power. There are barriers to entry at the urban market centers where the brokers provide the link between wholesalers and retailers. In many cases, the brokers and transporters determine the market price for each potato consignment delivered. The markets are integrated and price transmission does occur. However, price transmission is incomplete in the short run implied by the spatial arbitrage conditions which are wanting in the markets that were examined. The proposed interventions include facilitation and up-scaling market information sharing, investments in physical infrastructure (e.g. storage, roads) to facilitate trading activities. Provide incentives to encourage the engagement of public private partnerships in storage, distribution and

marketing of Irish potatoes. From a policy perspective, efforts should be made to facilitate arbitrage through the development of storage and physical market infrastructure.

Keywords: Market structure, Price transmission, Irish potato,

TH1ABS186

Nutrient uptake and yield efficiency of Exotic Sweetpotato Cultivars under organic Soil Management systems in Abeokuta Southwestern Nigeria

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Abstract

The need to evaluate the nutrient uptake and yield efficiency of crops under organic production systems is necessary mainly because of soil fertility degradation coupled with scarcity and expensive inorganic fertilizers. Field experiments were conducted at the Federal University of Agriculture Abeokuta, Nigeria in the rainy seasons of 2010 and 2011 to determine the optimum rate of composted cow dung and NPK fertilizer on Nutrient uptake and yield efficiency of exotic sweetpotato cultivars. Vines (20cm length) of four cultivars of sweetpotato cv.TIS87/0087,199000.1, Ex-Egbariam and TIS 86/0356 were planted at 0.3m distance on ridges spaced 1m apart. Four weeks after planting, composted cow dung (CCD) at 0, 2.5, 5.0, 7.5t/ha and 400kg/ha NPK 15:15:15 were applied. The treatments were arranged factorially in randomized complete block design with 4 replicates. Data on precropping soil analyses, leaf fresh and dry weight, leaf nutrient contents and tuber yield of sweetpotato plants were collected at harvest. Sweetpotato plants that received 7.5t/ha of CCD had significantly higher ($p<0.05$) leaf fresh and dry weights, leaf nutrient contents and higher tuber weight (6.8, 11.5 t/ha) for the two years, respectively. These values were significantly higher ($P<0.05$) than thoseobtained from sweetpotato plants grown without fertilizer (control) and those that received other fertilizer treatments. Sweetpotato Var. TIS86/0356 had significantly higher nutrient uptake and yield than the other three cultivars. Yield efficiency is in the order TIS 86/0356>TIS87/0087,>199000.1>Ex-Egbariam. Since nutrient uptake and yield are products of leaf drymatter, leaf N content and tubers weight, CPM at 7.5t/ha in combination with any of the four Sweepotato cultivars were therefore recommended for adoption by farmers. Other sweetpotato cultivars need to be evaluated for performance under different soil amendments and agro-ecology.

Keywords: Nutrient uptanke, Yield efficiency, Exotic- sweetpotato, drymatter yield,

TH1ABS171

The farming systems of potential potato production areas of Chencha, southern Ethiopia

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Abstract
A survey was conducted in 2012 to assess the diversity of farming systems in potato production areas of Chencha in southern Ethiopia. It was an entry for PhD research on evaluation and optimization of sustainability of farming systems which is part of an initiative to make the area a centre of excellence for potato. Household survey (n=57) and farmers group discussions were used to collect data from 21 villages. Mixed farming system was the prevailing system in the area where crops and livestock are simultaneously grown or reared. The major crop types grown in the area were potato, enset, wheat, barley and kale. Most crops were grown as food and cash crop. Crops like barley and enset were mainly grown for household consumption. Farmers used improved varieties mainly for potato (73%), wheat (77%) and barley (21%). There were two cropping seasons per calendar year and crop rotation was common in the area. The dominant rotation system practiced by 95% of the respondents was planting potato followed by wheat or barley. The common intercropping practices were mixed intercropping of barley with lentil and wheat with linseed. Kale was also inter-sown under enset and apple. Cattle, sheep, goats, horses and chicken were the main livestock types reared in the area. The common feeding systems were grazing on farms, feeding enset leaves, weeds, and crop residues and grazing on private pasture. Based on local classification there were twelve soil types. The common ones were Modo (dark loam), Gobo (red clay) and Kalta (brown clay). Fertilizers used were farmyard manure (97% of households), compost (40%), urea (78%) and DAP (81%). Farmers used low rates of these fertilizers due to shortage of cash. Most of the households (55%) obtained cash income from agricultural activities, mainly from crop production. The most important off-farm activity was weaving. Household food demands were met from own farm and external sources. Constraints of the farming system that need research and policy interventions include soil fertility degradation, low productive crop varieties and livestock breeds, shortages of land, feed, improved seed and cash.

Key words: Potato, farming system, Chencha, Ethiopia, *Solanum tuberosum*

TH1ABS190

Perspectives on GM technology ex-ante, expost biosafety legislation in Kenya: The case of sweetpotato

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Abstract
Exploitation of advances in biotechnology in crop improvement remains largely sub-optimal in sub-saharan African countries. Public perception and/ or polarized views in the public forum especially on genetic modification (GM) emerge as key obstacles that require to be overcome. Additionally, lessons learnt in Kenya during the GM sweetpotato (sweetpotato feathery mottle virus -SPFMV) project suggest that to a large extent, the slow progress in exploitation of biotechnology applications can also be attributed to absence of a proper legal framework to guide the handling and utilization of products of GM research. The absence of a specific legislation in Kenya, for instance, meant that guidelines and procedures for carrying out biotechnology related activities including the GM sweetpotato project were derived from the recommendations of the National Advisory Committee on Biotechnology Advances and Applications (NACBAA) and later the National Standing Committee on Biosafety. Hence, GM research in Kenya prior to enactment in 2009 of the biosafety legislation in Kenya was facilitated. Thus, innovative initiatives (analogous to Kenya's NACBAA and the National Biosafety Committee) by experts working in other SSA countries which lack biosafety legislation and their implementation will maintain the momentum towards realization of the full potential of biotechnology on the continent.

Key words: Biosafety, GM, sweetpotato

TH1ABS140

Risk of Uncontrolled Importation of Seed Potato from Europe to East and Central Africa: What are the policy options?

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Abstract

Potato (*Solanum tuberosum*) is an important food and cash crop, and is among the 10 strategic crops for food and income security in Eastern and Central Africa (ECA). Its importance continues to rise due to increased urbanization, change of eating habits and uptake of processed potato products. The area under the crop has continued to increase steadily over the years with the smallholder farmers dominating the sector. On-farm potato yields are commonly below 10 tonnes/ha compared to the potential yields of 40-60 tonnes/ha attainable by a progressive farmer. Poor quality of seed tubers used by farmers is viewed as a major yield-limiting factor while lack of suitable processing varieties has limited expansion in potato processing. Currently, high quality seed potatoes account for less than 7% of the whole potato seed market in ECA. This scenario has encouraged the common practice among potato farmers of planting own-saved tubers from previous harvests or sourced from markets or neighbours. Several initiatives have been undertaken by governments, stakeholders, private investors and development partners to address the challenge of unavailability of quality seed potato in the region. Introduction of rapid seed potato multiplication techniques (aeroponics), quality declared seed and positively selected seeds are among the practical solutions adopted and targeting farmers with different capacities. These initiatives have proved to have potential to increase potato productivity up to 5 fold in a short time. Seed potato import from European countries is also viewed as an alternative intervention. This option however risks clipping the development of the local seed potato subsector. Recent studies indicate that the local potato production risks collapse from such imports through introduction of foreign diseases and pests that are more virulent under tropical conditions. Diseases such as *Dicheya* ssp, new strains of late blight of A2 mating type and Bacterial Ring Rot are some of the dangerous diseases reported in Europe that risk being introduced in the region. European countries with low incidences of these diseases have undertaken measures such as voluntary banning while China and US have banned importation of tubers from Europe. Modern Pest Risk Assessment allows such banning for phytosanitary reasons if there is sound scientific evidence. Therefore, ECA countries also need to come up with an informed policy position that will protect small-scale farmers and local seed producers as they develop the potato sector.

Keywords: Diseases, Imports, Pests, Quality Seed Potato, Eastern and Central Africa

TH1ABS239

Policies for crop diversification in eastern and central Africa

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Abstract
Development of the agricultural sector in the countries of Eastern and Central Africa (EAC) continues to be constrained by weak vertical integration, inadequate institutions and support services, and the concentration of output in a narrow range of agricultural products for export or domestic consumption. Crop diversification is seen as a strategy that can help dampen food price inflation by facilitating greater availability of a broader mix of nutritious and versatile staple foods that are much less susceptible to volatile international markets, changing weather patterns and political machinations. Potato is an ideal crop diversification candidate as it is not massively traded in global commodity markets; it is suitable for cultivation in a wide range of agro-ecological conditions; and it is widely grown in countries where arable land is limited and unemployed labour is abundant. In the EAC countries potato is an important food and cash crop whose acreage continues to grow; and it is grown principally under smallholder production systems which are characterized by high population density. Despite its potential to contribute to the economic growth of the region the potato is hampered by serious constraints in a number of areas. The objective of this study was to develop policy guidelines that would stimulate accelerated growth in potato production and use; and help producers and consumers benefit in the process. Kenya was selected as a case study that was comparable to other EAC countries. Using brainstorming sessions, reviews and roundtable meetings with potato subsector actors and stakeholders we developed specific policy recommendations and policy options in 6 key areas. The areas are-; ware potato production; seed potato production; processed potato products; marketing of seed and ware potatoes; cross-cutting issues; and in desired legal institutional and regulatory framework. Implementation of these recommendations will spur the growth of the potato subsector and meet the challenges of diversification in Kenya and with adequate domestication -in other EAC countries.

Keywords: crop diversification, policy recommendations

Theme Two

Getting seed systems moving

TH2ABS003

Integration of in vitro techniques in informal seed production systems of potato in africa

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Abstract
Presently, Asia and Europe are the world's major potato producing regions accounting for more than 80 percent of world production. But harvests in Africa and Latin America are far smaller, and productivity revolves around 11-12 t/ha in comparison to North America where it is more than 40 tonnes/hectare. In Eastern Africa especially, potato (*Solanum tuberosum* L.) has a high potential to raise smallholder income and improve food security. Few seed potatoes are currently sourced from specialized multipliers, as farmers largely rely on farm/home-saved seed potatoes. This often makes economic sense in the absence of affordable high quality seed potatoes and limited market security. However, common practice of farmers to use home-saved seed [informal seed] carries the risk of 'concentrating' seed-borne pests, like bacterial wilt (*Ralstonia solanacearum*). In this region and much of the African continent, seed potato system interventions need to address the quality of specially multiplied and farm-saved seed potatoes simultaneously. A method known as "Seed Plot Technique" (SPT) now allows smallholders with limited access to land to multiply seed-tubers effectively, lessening the impact of home-saved seed practices in Africa. The SPT has been exposed to farmers in Kenya and Uganda. The 'FORMAL' potato seed production and distribution system has been found to be insufficient to fulfil seed requirement of growers. The other 'Informal' system is also in existence and works on mutual obligation/trust amongst growers for promised quality/variety of potato. In both the methods, integration of *in vitro* propagation technologies with traditional techniques is becoming necessary to augment availability of quality seed/planting material in sufficient quantity. The *in vitro* techniques facilitate cleaning up of virus/disease infested material, rapid and clonal production of propagules, viz. microplants (MP), micro-tuber raised plants (MTP) and microtubers (MT) in less time and space. Later, these are transplanted in greenhouse for production of clean mini-tubers which possess distinct advantages and here more *in vivo* methods like use of sprouts, stem cuttings can also be applied. INFORMAL system is much more important than FORMAL system in most of the potato growing countries. Possibilities of integrating *in vitro* technologies with *in vivo* methods under INFORMAL seed production chain in Africa to ensure uninterrupted supply of quality potato seed material are discussed.

Key words: Potato seed, in vitro techniques, informal system, micro/mini tubers

TH2ABS102

Adaptation and improvement of the seed-plot technique in smallholder potato production

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Abstract
Smallholder farmers commonly use tubers from previous harvests such as tubers that often habour tuber-borne diseases which lead to significant yield reductions. A seed-plot technique has been developed on a pilot scale to increase on-farm availability of quality seed potato. The objectives of this study were to validate this technology under diverse management circumstances and to determine the effect of fertilizer application on seed plot productivity as a way of increasing the gains obtainable from the technology. Validation trials were carried out in ten sites in Kenya and five sites in Uganda, where farmer groups established and managed plots by planting cultivar Asante (Victoria) at a spacing of 30x30cm. Productivity of seed plots was statistically similar across all the sites in the two countries, indicating that the technique was easily adaptable in many areas. Fertilizer trials were carried out in Meru Central District, Kenya, with cultivar Asante and two types of fertilizer, DAP (18: 46: 0) and Mavuno Planting (10: 26: 10). The fertilizers were applied at low and high rates based on nitrogen supply (45 and 90kg N/ha, respectively) in seed plots measuring 2.4m by 1.8m on which tubers were planted at a spacing of 30x30cm. Plots with no fertilizer application produced a mean of 102.50 seed-sized tubers per plot, which was significantly lower than the 163.25, 162.00, 155.75, and 133.50 tubers obtained from plots that received low DAP, high DAP, low Mavuno Planting and high Mavuno Planting applications. Plots that received low DAP and low Mavuno Planting applications produced relatively higher proportions of seed-sized tubers (74.12 and 72.02%) than the DAP-high and Mavuno Planting-high plots (68.50 and 63.72%), respectively. On the basis of these findings, the seed-plot technology, with improved productivity through fertilizer application, should be widely disseminated for increased availability of quality seed potato, especially in smallholder farming systems where frequent replenishment of seed stocks is hampered by financial inadequacies.

Key words: *Solanum*, potato nursery, improvement, productivity, on-farm availability.

TH2ABS146

Are dormancy management and physiological age the achilles' heel of aeroponic minituber production in seed potato value chains in SSA?

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Abstract

Scarcity of good quality seed is major obstacle to expanded potato (*Solanum tuberosum* L.) production in sub-saharan Africa (SSA). Constraints in availability and supply of seed potato are partly attributable to challenges in production of pre-basic which is an intermediary step necessary in production of seed tubers in the seed potato value chain. Aeroponic minutuber production is a relatively recent technology that has the potential to break the seed potato bottleneck in many SSA countries due to several advantages that it holds especially those related to high multiplication rates; typically (1:50-100) that arise from sequential harvesting. There are, however, a number of potential challenges which, if not addressed, can contribute to non attainment of the projected increases in seed availability and not only mess up the 3 generation (3G) revolution strategy of boosting seed tuber production in SSA but also jeopardize the adoption of the technology. Besides problems associated with failure of electricity supply and management of nutrition, the Achilles' heel of aeroponic minituber production is probably the large variation in physiological age of resulting tubers due to sequential harvesting that takes place over several months during the production cycle. In the absence of cold storage facilities which are few and beyond the reach of many pre-basic seed potato growers in many SSA countries, harvested minitubers can either be at dormant, apical dominance, multiple sprouting or senile stage when they are required for planting with significant impacts on subsequent yields. This paper discusses the problems associated with physiological age in seed tuber systems based on aeroponic minitubers and proposes some approaches that may overcome these challenges to ensure that the promise of aeroponic minituber production is realized. The proposed approaches include the strategic application of dormancy inhibiting and dormancy promoting substances at various stages of aeroponic minituber production combined with the use of low cost storage systems such as the diffused light storage technology depending on the dormancy period of the variety (ies) being grown.

Key words: Aeroponic minitubers, dormancy, dormancy inhibiting substances, dormancy promoting substances, physiological age, seed potato value chain

TH2ABS126

Assessment of technical and financial feasibility of seed potato multiplication using aeroponics and field techniques in Malawi

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Abstract

In Malawi, lack of quality seed potato was a major constraint in production. Farmers obtained planting materials from informal seed sources. From 2006/2007, the use of positive selection technique was introduced to farmers. Although positive selection proved very useful in improving quality of on-farm saved seed, the incidence of potato viruses detected as latent infection in selected tubers was relatively high. Production of higher quality seed required use of innovative techniques. This study was conducted to evaluate technical and financial feasibility of seed potato production using tissue culture, screen-house and field techniques. From 2008 to 2012, seed multiplication trials were conducted using in-vitro plantlets and aeroponics at Bvumbwe research station and Universal Industries Ltd (Njuli-farm) in Southern Malawi. Aeroponics seed tubers (G0) were planted under field conditions to produce generation 1 (G1), generation 2 (G2) and generation 3 (G3) seed tubers. Data collected included the number of plants survived, number of plants harvested, number of seed tubers, seed tuber weight, cost of production, and cost of informal seed produced by farmers. A mean of 30 tubers per plant was produced in aeroponics from 4 genotypes tested. Five to seven tubers of 47 grams each were harvested per planted tuber in the field. Mean number of tubers produced per harvested plant was 9.0 ± 1.9, 10.8 ± 2.0 and 14.4 ± 3.2 for varieties Zikomo (CIP381381.20), Thandizo (CIP381381.13) and Chuma (CIP395015.6), respectively. The cost per seed tuber produced at G0, G1 and G2 was USD 0.30, USD 0.080 and USD 0.034, respectively. This corresponded to a cost of G0, G1 and G2 seed per ha of USD15,000, USD 4,000 and USD 1,700, respectively with a planting density of 50,000 seed per ha. Selling price of informal seed by farmers was USD 0.04/tuber (USD 0.8/kg). A scenario of a third field multiplication (G3) with 450,000 seed tubers produced resulted in a very competitive production cost of USD 0.0122 per tuber (USD 0.256/kg) that could enable seed growers fix selling price with a 100% profit margin, at USD0.0244/tuber (USD0.512/kg) while maintaining competitiveness. Profit and competitiveness was guaranteed with at least 8.2 and 5.4 seed tubers produced per planted seed in production of field generation 2 and generation 3 seed, respectively. It was concluded that the use of aeroponics and field techniques was technically and financially feasible.

Key words: Seed potato, aeroponics, multiplication, feasibility

TH2ABS089

Comparison between fluorescent lamps and light-emitting diodes on *in-vitro* growth of potato micro-plants and subsequent *in-vivo* performance and mini-tuber production

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Abstract

Morphogenesis, growth and tuberization of potato in *in vitro* conditions can be influenced by light quality. Plant tissue culture normally uses fluorescent lamps (FL) to provide the red (R) portion of the light spectrum and lots of green light, which is usually reflected from leaves leading to low efficiency per quantum of light within PAR range. New light sources such as light-emitting diode (LED) lamps would provide more PAR for *in vitro* plant growth in addition to being energy efficient with low heat emission. Consequently, experiments were conducted to study the effect of LED's and FL on *in vitro* growth and subsequent mini-tuber production in tissue cultured potato plantlets of three European potato varieties, Kardal, Melody and Timo. The LED's were tested at a low, 76µ mol $m^{-2}s^{-1}$and high, 120µ mol $m^{-2}s^{-1}$, light intensity and compared with FL at 120µ mol $m^{-2}s^{-1}$ as control. For each variety, three plantlets representing one repetition in each light source were used. Results show that rate of plantlet growth, the number of nodes, internode length and average plant height after four weeks in *in vitro* growth were significantly (P≤ 0.05) affected by potato variety and light source but not their interaction. However, potato plantlets grown in LED's conditions had more nodes than plantlets grown under FL. Shoot biomass was significantly (P≤ 0.05) influenced by potato variety but not light source while root weight was significantly (P≤ 0.05) influenced by both potato variety and light source. Plantlets grown under low LEDs intensity had a significantly lower root weight than plantlets grown under high LEDs intensity. There were no significant differences in both root and shoot weight among plants grown under both FL and LEDs at 120µ mol $m^{-2}s^{-1}$. Light source during micro-propagation did not significantly (P≤ 0.05) affect mini-tuber production in *in vivo* conditions except patato variety where Timo produced significantly (P≤ 0.05) more tubers per plant than Kardal and Melody. LED lamps at 120µ mol $m^{-2}s^{-1}$ offered similar growth in plant tissue culture as FL and have advantages of high energy efficiency and longer durability than FL. Therefore, future plant tissue culture consider LEDs as a better alternative to FL for provision of light energy in controlled plant growth environments as a means of saving energy without compromising plantlet performance.

Keywords: *PAR, micro-propagation, in-vitro light quality, residual light effects*

TH2ABS217

Cost-effective methods of seed potato production in Ethiopia

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Abstract

Improved potato varieties can increase potato yields of smallholders and thus contribute to food security improvement in Ethiopia. However, the uptake of these varieties by farmers is very limited so far and is one of the causes of insufficient seed quality in the seed potato system in Ethiopia. The objective of this study was to develop cost-effective seed potato production plans for farmers in Ethiopia. The paper used integer linear programing and the perceived contributions of production and postharvest management and costs to determine cost-effective plans. Results show that in districts of Jeldu and Welmera, several plans were developed from which farmers can choose an affordable plan that will enable them to produce seed potato with reasonable yield and quality levels. Results also show that yield and quality levels could be simultaneously improved at relatively low extra costs. In both districts, most plans were robust at 50% increases in the rental values of land, prices of seed, wage rates, and prices of agrochemicals. Findings can be used by potato development practitioners to advise farmers on the adoption of seed potato technologies that are compatible with their financial resources.

Key words: Cost-effective production; linear programming; management attributes; seed potato; production plan; Ethiopia

TH2ABS053

Effect of culture media on *in vitro* performance and minituber productivity of *solanum* potato

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Abstract

The composition of plant tissue culture medium greatly influences *in vitro* performance and minituber productivity of potato (*Solanum tuberosum* L.*)*. The effect of three different auxins namely; indole acetic acid (IAA), naphthalene acetic acid (NAA) and indole butyric acid (IBA) at a level of 1.0mgl^{-1} was evaluated for the *in vitro* performance and minituber productivity of potato variety Kachpot 1. These were compared with basal Murashige and Skoog (MS) medium. This study was carried out at KAZARDI tissue culture laboratory and repeated

three times Thirty six (36) plantlets were studied for each set of media for four (4) weeks and data collected weekly before transplanting to the soil media for minituber productivity. Shoot tips were inoculated to eliminate differences in differentiation. Initiated cultures were placed in the growth room at a temperature of 18^{o}C and light intensity of approximately 1000 lux and a photoperiod of 16 hours. Twenty plants (20) were planted for each treatment in four replications at spacing of 20cm X 10cm. Shoot height, number of nodes, number of leaves and roots progressively increased over the culture period while the number of shoots did not differ significantly. Maximum plantlet height was recorded (4.3 cm), highest number of leaves per plantlet (7.8) and largest number of nodes per plantlet for IBA (6.7). Extensive number of roots per plantlet was recorded for IAA (6.8), followed by NAA (6.6) and least for basal MS (4.1). The highest number of reproductive buds was produced by IAA (4.6) and least for basal MS. However, basal MS produced more leaves (7.7) than NAA (6.9) and IAA (7.2). More minitubers on average were recorded for IBA (8.4) followed by NAA (8.1) and least for basal MS (6.9). IBA enhanced *in vitro* performance greatly when compared to other auxins studied and consequently led to more minitubers being produced. IBA is therefore recommended for routine micropropagagtion of *solanum* potato as an auxin.

Key words: Potato, media, auxins, *in vitro*, minitubers

TH2ABS065

Effect of long-term *in vitro* sub-culturing on quality degeneration of sweetpotato varieties: morpho-anatomic assessment and Simple Sequence Repeats (SSR) analysis

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Abstract

True-to-type clonal fidelity is one of the most important pre-requisites in micro-propagation of crop species. The aim of this study was to assess the effect of long-term *in-vitro* sub-culturing on the variety degeneration of three sweetpotato varieties (Monate, Mokone and Ndou). Monate was subcultured for 32 generations whereas Mokone and Ndou were subcultured for 23 and 12 generations, respectively. The media used for subculturing was made from 4.4 g l^{-1} of MS (Murashige and Skoog) salt, 30 g l^{-1} of sucrose and 2 g l^{-1} of Gelrite. The plantlets were grown in 16 hours light and 8 hours dark photoperiod for 30 days and single node cuttings taken from the 30 days old plantlets were used as explants source to subculture the next generation. From each generation 45 plantlets were transplanted and grown for two month in a glasshouse environment. Data on *in-vitro* growth performance as well as morphology during acclimatization were recorded. The plantlets which showed change in morphology traits were subjected to genetic analysis by using five Simple Sequence Repeat (SSR) primers (IB-242, IB-318 IB-255F, IB-248 and IB-255). Significantly higher growth performance such as stem height, leaf number, internode length as well as early root and shoot organogenesis were observed after the 27th and 21st sub-culture generations of cv. Monate and Mokone, respectively. Furthermore, plantlets of the same variety showed differences in morphological traits such as leaf colour, abaxial leaf pigmentation, vine pigmentation, petiole pigmentation, leaf wrinkling and percentage of flowering. However, there was no correlation between the sub-culture generation and the degree of morphological variability. From the five SSR loci only Ib-255F and Ib-318 were

able to distinguish the three cultivars. However, none of the primers used in this experiment could show allelic polymorphism between short term and long term propagated plantlets. Therefore, long-term nodal sub-culture did not lead to quality degeneration of sweetpotato cultivars Monate, Mokone and Ndou.

Key words: Micro-propagation, organogenesis, sub-culture, true-to-type, morphology, polymorphism

TH2ABS027

Effect of Seedbed Types and Vine Length on Performance of Sweetpotato in Semi-Arid Eastern Kenya during the 2005 – 2006 Short Rains Season

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Abstract

Sweetpotato is an important staple in the arid and semi-arid lands of Kenya. Variety development has been going on without accompanying agronomic packages. The performance of three sweetpotato cultivars under four seedbed types in Kambi ya Mawe (Wote) and Ithookwe (Kitui) was studied. The three elite sweetpotato cultivars, 199034.11, SPK004 and Ex-Kiambu were planted on the flat, mound, furrow and ridged seedbeds at KARI Kambi ya Mawe (Wote) and Ithookwe (Kitui) farms during the 2005 – 2006 short rains (November - March) and harvested 5 months later. Clones 199034.11 planted on the flat, mounds and furrow, and Ex -Kiambu planted on the flat, mounds and ridges had the highest total tuberous root yield at Kambi ya Mawe. Clone 199034.11 planted on the flat, mound and furrow seedbeds produced the highest foliage (vine) yield. On the other hand, local cultivar Ex-Kiambu planted on the flat, furrow and ridge had high foliage (vine) yield at Kambi ya Mawe. Clones SPK004 and local cultivar ex -Kiambu planted on the ridges and mounds had the highest total tuberous root yield at Ithookwe. Clone SPK004 planted on the ridges and mounds seedbeds produced significantly higher foliage (vine) yield than those on the flat and furrows. On the other hand, local cultivar Ex-Kiambu did not show significant differences in foliage (vine) yield produced in the four different seedbed types. All cultivars had more marketable tuberous roots than non-marketable ones irrespective of seedbed type and agro-ecological zone.

Key Words: Sweetpotato, seedbed types, vine, marketable roots, semi-arid lands

TH2ABS029

Enhancing potato basic seed production synergistically using stem cutting and hydroponic technology to upscale potato production in Kenya: A review

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Abstract

The basic technology of potato (*Solanum tuberosum*. L.) stem cutting has enhanced exponentially the quantities of seeds produced in the Kenya National potato programme due to the possibility of transplanting many stems at high density either from *in vitro* plantlets cutting; stem cutting and conventional seed tubers cuttings to produce small, disease free high quality tubers for subsequent field multiplication. The performance of seed tubers harvested from potato plants grown from *in vitro* plantlets cutting, stem cutting and conventional seed tubers cuttings are discussed explicitly with reports showing the performance of seed tubers produced from *in vitro* cutting as better in respect of plant growth, tuber number and tuber yield per hill as compared to seed tubers obtained from stem cutting or conventional method which has therefore shown its high potential utilization in upscaling the basic seed production in Kenya. At Kenya Agricultural research institute (KARI), Tigoni, we have developed a rapid cost effective stem cutting method in enhancing basic seed production. This has shown that the technique when used synergistically with the hydroponic technology is not only rapid and efficient but is applicable to a wide scope of potato genotypes which shows that there is the possibility of reducing perennial seed problem. Presently KARI, Tigoni can only supply a limited quantity of less than 1% of the national seed requirement. To ensure that the potato subsector plays its rightful role in increasing seed production deficit that is curtailing its increased yield production, it is necessary that seed production challenges along the value chain be tackled in a sustainable manner since the farmers still practice the same agronomic methods that were adopted in the 70s when the cultivation acreage was big. Therefore, this review paper outlines the progress achieved in the use of stem cuttings and hydroponics technology for production of high quality basic seed potato in Kenya.

Key words: Hydroponics, Stem cuttings, Genotypes, In vitro, Plantlets

TH2ABS161

Evaluation and promotion of sustainable farmer seed supply systems for vegetatively propagated crops in Central and Eastern Kenya

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Abstract

Several interventions aimed at addressing seed insufficiency and by extension food production and security have been put in place. Access to good quality seed of improved crop varieties for vegetatively propagated crops continues to be a major challenge to the farmers. This paper analyses the seed supply systems for vegetatively propagated crops in Kenya. In 2010, data was collected from randomly and purposefully selected households, farmer groups and key informants in Central (Nyeri, Mukurwe-ini and Nkubu) and Eastern (Kitui, Matuu and Embu) respectively using sweetpotato as the study crop. A semi structured questionnaire and a check list was used during the interviews. Data was also generated through focus group discussions. Data was analysed using excel and statistical packages for social scientists. Information generated from focus group discussions was used to enhance the information generated through the household and key informant interviews. The results indicated that 42.2% of the farmers' access seed from Kenya Agricultural Research Institute while 38.5% access seed through farmer to farmer exchange with 35% through farmer to farmer seed system with a commercial orientation and 11.1% through the government-led seed systems respectively. However, farmers (97.1%) recommended the farmer to farmer seed system with the commercial orientation as the most sustainable system. This was particularly reported in Central Kenya where the system was well known. According to the farmers the system gave them the opportunity to access new crop varieties, quality seed and on time for planting. This gave them the opportunity to take advantage of first rains, contributing better crop performance and improved crop production and hence improved food security. The system also allowed the farmers particularly the groups to generate income through the sale of cuttings. Government-led system which is a new government initiative towards improved food security and poverty alleviation in the country had several challenges. Although the system offers farmers the opportunity to access improved/new crop varieties, the seed gets to farmers late and in a deployable state for planting; at times after the rains have stopped and farmers having utilized all the available land. Therefore farmer seed enterprise should be enhanced and promoted for sustainable agricultural production of vegetatively propagated crop, improved food security and poverty alleviation.

Key words: Farmer seed enterprise, commercialization, vegetatively propagated crops

TH2ABS028

Evaluation of two major potato varieties under aeroponic conditions in Rwanda

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Abstract

Productivity of Irish potato (*Solanum tuberosum*) is constrained primarily by use of low quality seeds in Rwanda. Many field multiplication generations of vegetative propagated basic seed result in build-up of seed-borne diseases and subsequent dissemination to new fields. Soil-less production of mini-tubers is an alternative solution to reduce the rate of soil-based diseases and increases yields per plant. The objective of this study was to determine the adaptability and optimum plant density of potato varieties in Rwanda under aeroponics production system during 2010/2011 at RAB- Musanze station. Two commercial potato varieties (Kinigi and Kigega) were evaluated in an aeroponics greenhouse at 14, 17 and 21 plants per m^2 using a split plot design with four replication. Plant densities were assigned to main-plots and varieties were in the sub-plots. Nitrogen, Potassium, Phosphorus, Calcium, Magnesium and other micronutrients were supplied to plants by way of a mist nebulizer in an enclosed environment where there is no wind to move the mist away. Raw data were analyzed using statistical software called GenStat. Analyses of variance showed highly significant ($p<0.01$) differences between the two varieties for plant height, number of nodes at nine weeks and at eleven weeks after transplanting, days to maturity and tubers per plant. Plant density and variety × density interaction effects were not significant ($p>0.05$) for any of these parameters. Plants in Kinigi variety were about 50% taller 3, 5, 7 and 9 weeks after transplanting, developed 2.5 more nodes, matured 49 earlier, 29 more mini-tubers than Kigega. The data showed that, Kinigi was more adapted and productive in the aeroponics environment than Kigega; and plant population density had no significant influence on productivity in the system. Response under aeroponics is cultivar dependent and requires testing more varieties to select the most adapted for production in this system. There is a need to incorporate this system in the potato seed program to guarantee high-quality seeds to Rwandan farmers.

Key words: Potato seed, cultivars, mini-tubers, aeroponics

TH2ABS182

Management of aphid-borne viruses in seed potato production

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Abstract

Irish potato is the second most important food crop in Kenya after maize and plays a major role in food security and alleviation of poverty through income generation by providing employment opportunities in production, processing and marketing sectors. Major contributing factors to low yields include unavailability of certified seed tubers, bacterial wilt, fungal and virus diseases. The informal seed sector contributes about 99% of the seed tubers and farmers recycle tubers saved from previous harvests. This contributes to spread of seed borne diseases. Aphids and aphid-transmitted virus diseases reduce potato yield by as much as 70-90%. with the green peach aphid, *Myzus persicae*, being the most important vector of virus diseases. Potato leaf roll virus (PLRV) and Potato virus Y (PVY) can decrease yields by 50-80% in crops grown from infected tubers. Co-occurrence of different viruses leads to higher yield reduction. Virus infection continues during storage because aphids attack sprouts in the diffused light found stores. Early planting in areas where aphid population is low helps avoid heavy aphid infestation while roguing early in the season minimizes the risk of virus spread. Dehaulming early prevents late-season virus infection. Insecticides may be used to reduce aphid populations thereby reducing within season spread. However, insecticides are not completely effective on non-persistent transmitted viruses. Combination of conventional insecticides with mineral oil and use of aluminum or white plastic mulch reduce virus transmission, especially for non-persistent viruses. Border crops around small scale seed potato crop also reduce non-persistently transmitted aphid-borne viruses.

Key words: *Solanum tuberosum*, seed degeneration, aphids, potato viruses

TH2ABS184

Managing Sweetpotato Seed System Using a Value Chain Approach: Lake Zone, Tanzania

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Abstract

Sweetpotato is a vegetatively propagated crop which is cultivated by recycling planting materials from the old fields like any other vegetatively propagated crops. One of the critical problems facing sweetpotato growers is shortage of clean planting materials at the beginning of planting season particularly in the drought prone and high disease pressure areas. Farmers in many areas solve this problem through conserving planting materials near water sources, in the home garden, store roots which they sprouts at the onset of rains, do sequential planting immediately after onset of rains to get enough materials for field expansion. Different sweetpotato planting material production, conservation and dissemination approaches have been developed and tested. These include rapid multiplication techniques, use of tubers, and primary, secondary and tertiary multiplication. Sustainable source of clean sweetpotato planting materials provide an opportunity to farmers to access clean seeds of quality varieties particularly at the time of planting at the beginning of growing season. In the Lake Zone of Tanzania Innovative Platform Technical Adoption (IPTA) was adopted under DONATA project to multiply and disseminate sweetpotato planting materials of orange fleshed varieties (OFSP) in the four districts (Ukerewe, Bukoba, Misungwi and Sengerema). Four IPTAs were formed in four participating districts. A total of 12 different actors with different roles were involved as IPTA members. Each actor had his/her own role to play to support the sweetpotato value chain. The actors involved were: Researchers (*technical backstopping*), Local government (*supportive role*), NGOs (*training and support activities*), traders (*purchase and selling of vines, roots and processed products*), farmers (*production of vines and roots*), Government institution (*production of vines & roots, advice, awareness creation, quality control, technical backstopping*), BDS (*Supportive role*), Media (*Advocacy and broadcasting*), Private (Production, product transformation and promotion), CBOs (*Production, transformation and marketing*), FBO (*Production and awareness creation*). All actors worked to promote planting sweetpotato of orange fleshed nature. A total of 2,327 households benefited directly from this intervention. More than 500,000 vines of OFSP varieties were produced at secondary sites and sold to sweetpotato producers over a period of two years. Shortage of planting materials at the beginning of the season has been solved in the target areas. Linkage between different actors along sweetpotato value chain actors through formation of production, processing and marketing groups, awareness creation programs and training sessions lead to sustainable seed systems. It is recommended that for sustainable sweetpotato system, all value chain nodes should be supported concurrently.

TH2ABS055

Media and genotype effects on growth and mini tuber yield for potato (*Solanum tuberosum L.*) seed production in Malawi

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Abstract
Potato farmers in Malawi and other developing countries lack healthy and quality potato seed. This is due to limited multiplication programme to provide farmers with clean potato seed. A study to evaluate the effect of media and genotypes on growth and seed yield performance of micro-propagated potato genotypes under green house would assist in planning for future selection of good high yielding varieties and rapid seed multiplication programme of pathogen free planting materials to increase production of potato in the country. Three different media (vermiculite, sand and sawdust) and seven different genotypes (two local genotypes- *Magalabada* and *Rosita,* five introduced genotypes-Up to date, Buffelspoort08, Van der plank, Lady Rosetta and Bp 1 2007) were investigated. Pathogen free potato plantlets were produced in the tissue culture laboratory and then transferred to green house for mini tuber production. The plantlets were planted with 10 cm distances between rows and 10 cm between plantlets in trays filled with media. The study revealed significant (P≤0.05) variations between and among media and genotype tested on growth and yield characteristics. Genotype Rosita grown on vermiculite produced highest plant height (45.87cm). Similarly plantlets grown on vermiculite performed better with higher mini tuber yield of 1740g/m^2 for all genotypes while 850g/m^2 and 292 g/m^2 in sand and sawdust respectively. Among the genotypes Up to date and Lady Rosetta produced more tubers of between 12 tubers/plant and 10 tubers/plant. Thus vermiculite increases the number and size of minitubers which is a very important step for rapid multiplication of potato seed. The study findings provides valuable information on potato minituber production using different media and potential genotypes which would assist in scaling up seed multiplication programmes for pathogen free planting materials.

Keywords: media, genotype, *Solanum tuberosum,* minituber, micropropagation.

TH2ABS085

Multi-stakeholder framework for intervention in VPC seed systems: potato and sweetpotato applications

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Abstract
Vegetatively propagated crops face similar challenges in terms of availability, and accessibility of planting material, with the quality that is required by small-scale farmers. In the case of potatoes, investments for improving seed systems started about four decades ago, but most farmers in developing countries still use poor quality seed. In the case of sweetpotato, investments started more recently but the situation is similar. One of the limitations is that in most cases the experiences of seed-related projects have not been documented properly. Most of the documentation focused on the technical and agronomic aspects of seed production, and just a few of them look at other factors in an integral way, One of the reasons is the lack of a conceptual framework for analysis of seed systems with a multi-stakeholder and integrated (practical problem) perspective. This paper proposes a framework aiming at supporting analysis and decision-making by farmers, public or private organizations and other stakeholders interested in improving potato or sweetpotato seed systems. The framework has two basic axes. One has an actor orientation, and starts by identifying all stakeholders related to seed production, dissemination, trade and use; each with its own desired, aims, and roles in the system. Actors might include farmers as individuals or families (gender aspects included), national research organizations and their role in developing multiplication techniques or disease detection methods, formal seed parastatals, government extension services, government agencies in charge of seed regulations, NGOs, private companies, seed traders, and also international organizations. The inclusion of stakeholders is highly context-dependent, so not all of them would be relevant in a given situation. The second axis of the framework concentrates on the features need for successful seed system functioning. Hence, the analysis continues by identifying what stakeholders do (or could do) in terms of ensuring: 1) seed availability or supply, 2) access to seed, including delivery and dissemination channels, information and awareness-raising, 3) market aspects related to demand, affordability and cost-benefits for seed of higher quality; and 4) the issues of quality associated with a) variety characteristics and to b) phytosanitary and physiological aspects. The use of such a matrix framework will help stakeholders to identify and analyze their existing aims, roles and responsibilities in a diagnostic stage, and, more importantly, to identify entry points or changes in the roles and responsibilities in an implementation stage, which would have implications for research, information and knowledge management and investment. The next step is to validate the conceptual framework in order to identify and implement interventions in a set of contrasting VPC seed systems. Through a learning alliance constructed with the CGIAR RTB program the results will improve the framework, with cross learning to other vegetatively propagated crops such as cassava, yam, banana, aroids and Andean roots and tubers.

TH2ABS087

Needs assessment of sweetpotato production in northern Ghana: implications for research and extension efforts

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Abstract

A sweetpotato community needs assessment was carried out to generate relevant information to describe the prevailing production, marketing and utilization in six selected communities of the three northern regions of Ghana. The assessment was carried out using Rapid Rural Appraisal tools, including focus group discussions, key informant interviews, seasonal calendars, problem solving tree, decision making matrix, problem census and prioritization matrix. Six communities were selected based on their involvement in sweetpotato production, two each from the three northern regions. An average of 30 farmers participated in this study at each site. Male and female representation was 60% and 40% respectively. Sites in Upper West and Northern Regions were chosen to coincide with benchmark sites for a multi-partner CGIAR systems research and development program. Northern and Upper East Regions reported higher yields ranging from 25-30 jute sacks (120kg) of fresh sweetpotato per acre if fertilizer was applied. Upper West had lower yields of about 12-15 jute sacks (120 kg) of fresh sweetpotato (No fertilizer applied). Northern and Upper East Regions also had a benefit-cost ratio of about 2.5 compared with that of the Upper West Region of 2.05. Lack of planting material was a major limiting factor to the expansion of sweetpotato production especially in Northern and Upper West Regions. Though Upper East Region acknowledged this, they however mentioned lack of sufficient farm implements to plough their fields to be the major factor limiting increased production. Lack of good market sources was an important limiting factor to production in all regions. Producers unanimously agreed that the availability of good output market would motivate expanded production. About 5 varieties were identified in upper east region with 3 and 4 identified in Northern and Upper West Regions, respectively. This was mainly based on flesh and skin colour of the sweetpotato, with orange-fleshed sweetpotato being well-known at each location. It was economically feasible to increase cost by applying fertilizer and still increase returns on investment. In general, there was great potential for the development of sweetpotato at locations surveyed since the crop is well-known and well-adapted.

TH2ABS130

Mini-tubers: opening a new frontier to enhanced basic seed potato production in Kenya

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Abstract
Seed potato is a vital input in potato production. It is the physiological basis for vigorous crop development, genetic basis for adaptation to varied ecological and sometimes product quality. At the Agricultural Development Corporation (ADC) Molo Complex, in Molo, Kenya, a formal seed potato production system exists. However, over the years, it has not been able to produce sufficient quantities of certified potato seed to farmers due to shortage of basic seed from the national potato program, lengthy field multiplication associated with potato and low yields. Consequently, seed shortage has led to farmers obtaining planting material from alternative sources including: the local markets, neighbours or self-saved seed. This has resulted into build-up of seedborne diseases like bacterial wilt and viral diseases which lead to low yields and poor quality of tubers. An improved certified seed potato production scheme based on *in vitro* generated mini-tubers using aeroponics will be capable of ensuring sustainability in seed multiplication, a system is now underway at ADC through collaboration with CIP. Using the new scheme, var. Kenya Mpya and Sherekea the technology has worked well in getting healthy, true to type basic potato seed, rapidly, in a timely manner, under reduced field generations hence lowering costs and raising the plant health quality of the field production generation. With reduced field generations and a precise set of recommended agronomic practices and inspection services by KEPHIS the seed potato produced has improved in trueness to type, quality and quantity. Potato being a promising food security crop in Kenyan households, production is expected to significantly increase, contributing to poverty alleviation through income generation, provision of employment opportunities through value addition enterprises in production, processing and marketing. Mini-tuber production system is thus seen as a new frontier that will open a window for production of own breeder's seed at ADC, resulting in enhanced sustainability as a model for formal seed potato production system, to smallholder farmers particularly in Kenya and Africa in general.

Key words: seed potato, minituber production, ADC; food security.

TH2ABS246

4C 7T Seed Potato Initiative: A Multi-Institutional Collaboration to Enhance Availability and Access to Certified Seed Potato in the North Rift Region of Kenya

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Potato (Solanum tuberosum L.) is an important source of food security crop, household incomes and employment in Kenya. However, there is lack of readily affordable quality seed. Farmers rely on farm-saved seed which spread seed borne diseases. Initiatives on production and use of certified seed by KARI Kitale together with KEPHIS, Ministry of Agriculture (MOA) and other stakeholders in the North Rift region was started through informal arrangements with farmers. The objectives were to enhance certified seed potato production through strategized seed multiplies in counties to complement the formal seed supply. The number of growers increased and quantity of seed available. The increase in number of seed growers was attributed to enterprising farmers finding an alternative income source and persistent seed growers. The total number of certified seed potato growers was significantly high in Elgeiyo Marakwet and Trans Nzoia compared to Uasin Gishu, Nandi and West Pokot Counties. The variety Tigoni was the most popularly grown (76%) in the region as a result of the high demand for chips in urban (Fig. 3). The seed accessibility and high prices negatively influenced the area of seed potato planted each year in spite of the increase in number of growers.

Key words: Certified seed potato, availability, accessibility

TH2ABS215

Performance of seed potato supply chains in Ethiopia

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Abstract
In Ethiopia, seed potatoes are required for production of ware and seed in different seasons, under different production conditions and for different production purposes. To satisfy the diversity of demands, different seed potato supply chains are required. Currently, knowledge on management and performance of existing Ethiopian seed potato supply chains and the impact of improvement options on performance is lacking. The objectives of this study were to describe existing and potential seed potato supply chains, and to evaluate their performance. The results showed that seed quality is a more important seed supply chain performance indicator than costs, flexibility and responsiveness, for improving overall performance of seed potato supply chains. Sub-indicators to evaluate seed supply chain performance, i.e. production costs, seed purity, seed genetic quality, seed health, appropriateness of potato seed size, seed physical damage, appropriateness in physiological age, mix flexibility, volume flexibility and lead time, can be better improved by seed potato supply chains that supply seed tubers of improved varieties than by a chain supplying seed tubers of local varieties. The results also showed that actors in a seed potato supply chain differed in their relative contributions to the performance sub-indicators implying that a larger improvement in a seed potato supply chain with respect to a specific sub-indicator can be achieved by improving that sub-indicator at the actor level that has a larger relative contribution.

Key words: seed potato, supply chain, performance, Ethiopia

TH2ABS243

Phenotyping and genotypying sweetpotato for use in breeding for development of highland sweetpotato varieties

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Abstract
Growing food insecurity in Kenya has led farmers living in the highlands of Central Rift Valley to demand sweetpotato planting material. However, many farmers have unwittingly collected planting material that are of poor quality and do not undergo tuberization in the cool high potential highlands leading to great disappointment and distress particularly where the crop is sought for food. Furthermore sweetpotato traits are environment dependant. Though phenotypying of the lines had been done for this germplasm growing in the gene bank at Muguga, farmers' lines and other research lines had not been phenotyped. The purpose of this study was to phenotype and genotype Kenyan germplasm at Njoro with a view to recommending lines for use in highlands. We used traits that included colour and

shape of leaves, colour, length, weight and thickness of vines and roots, and molecular markers to identify 254 lines. The trial was planted on raised seedbeds at KARI Njoro in an RCBD nested design with un-replicated bulk plots. Results show that the germplasm had duplicates in name but differing in phenotype. For example, Nyathi odiewo had four duplicates but of slightly differing phenotypic character. The genotypic information showed that there was very limited diversity between the germplasm with lines having a source from Kenya and else where in Africa clustering together, while lines from CIP clustered in a second group. The identification of sweetpotatoes for highlands has enabled us to enhance the quality of products coming out of the sweetpotato crop improvement programme whose objective is to avail varieties to farmers in highland sweetpotato zones.

TH2ABS046

Piloting of Informal Potato Seed Inspection Scheme: First Results from Ethiopia

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Abstract

An informal seed inspection scheme for the production of quality potato seed tubers is being piloted in Ethiopia. The scheme builds on the FAO/CIP concept of producing Quality Declared Planting Material (QDPM). The QDPM concept is recognized by the Ethiopian seed legislation as an option to increase the availability of quality seed potato, however, implementation procedures for vegetatively propagated crops have not yet been developed and tested. It is the purpose of this paper to summarize first findings made with an informal seed inspection scheme. The QDPM scheme in Ethiopia suggests that two inspection committees (COM 1 and COM 2) carry out 2 field and 1 post-harvest inspection. COM1 consists of representatives of the concerned seed producer cooperatives who have been trained in field level seed crop inspection methods and COM2 technical experts from the official, district-level R&D system. The first field inspection is done by COM 1 six weeks after planting, the second field inspection (at flowering) and the post-harvest inspection are done jointly by both committees. The system is being piloted in 8 districts in 3 federal states, involving 14 seed producer cooperatives. Over the period from August to November 2012, 135 fields were inspected, out of which 116 were accepted as seed plots and 19 were rejected. Post-harvest inspections are scheduled for January 2013. Experiences to date indicates that: (1) QDPM objectives and procedures need to be clearly communicated to both involved technical staff and district-level administrators to create confidence and ownership, (2) peer control among cooperative members is an effective tool to maintain quality standards and (3) while some districts cover costs for transport and per diems, alternative payment mechanisms need to be developed for those unwilling to do so. Ideally, these activities should become part of the regular work programme with budgets provided by the concerned agencies. It is recommended to continue piloting for an additional season, to review the experiences and feedback and, subsequently, to operationalize the concept at a national level.

Key words: Ethiopia, Seed potato, Quality declared seed, Informal seed inspection

TH2ABS058

Positive selection to improve quality of farmers seed potato

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Abstract

In Kenya, poor seed potato quality is often a major yield constraint in potato production as smallholder farmers use farm-saved seed without sound management of seed-borne pests and diseases such as bacterial wilt and viruses. Farm-saved seed is therefore often highly degenerated. We carried out on-farm research to assess whether farmer-managed positive seed selection approach could improve yield. Positive selection gave an average yield increase in farmer-managed trials of 30%, corresponding to an increase in profit per hectare of only €6. Thus positive selection can be an important alternative and complementary technology to regular seed replacement, especially in the context of imperfect rural economies characterized by high risks of production and insecure markets. It does not require cash investments and is easily accessible to potato producers. It can also be applied where access to high quality seed is not guaranteed. The technology is also suitable for landraces particularly for cultivars that cannot be multiplied formally. Finally, the technology fits seamlessly within the seed systems of Sub-Saharan Africa, which are dominated by self-supply among neighbours.

Keywords: Potato seed quality, farm saved seeds, positive selection, viruses, bacterial wilt, degeneration

TH2ABS072

Possible pathway to formal seed potato production in Sub-Saharan Africa: experiences, successes, outcomes, impact, challenges and prospects for developing a formal seed potato system in Uganda

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Abstract

Seed accounts for 40 and 50 percent of potato production cost but is often one of the most compromised farm-input among smallholder farmers in the highlands of sub-Saharan Africa (SSA) who depend on potato as a major source of livelihood. This is partly due to poverty, lack of farmer awareness, subsistence farming, inadequate or inaccessible seed and

dependence on government agencies to produce and distribute quality seed. In recognition of this, the potato program in Uganda under National Agricultural Research Organization (NARO) with the International Potato Centre (CIP) started an initiative in 1996 to train, engage and support selected smallholder farmers in south western Uganda to produce and distribute improved seed potato to other farmers in an organized manner. Assessment of this initiative in 2010 among participating farmers revealed evolution of a self-sustaining, farmer-managed seed potato producers' association, high reduction in waste of basic seed which was formerly distributed through the agricultural extension system, wider quality seed dissemination and development of smallholder seed potato production and distribution business. Data showed increase in quantity of basic seed procured by farmers for bulking between 1996 and 2010. The study revealed gradual transfer of seed production, distribution and quality control costs from agricultural research and extension departments to farmers. The study also showed that basic seed potato was cheaper than improved seed potato produced by farmers possibly indicating the former is subsidized or demand and supply for seed potato in Uganda has not reached equilibrium. The increase in demand for basic seed by seed producers offers opportunities for expanding basic seed potato production by NARO or new investments by the private sector in Uganda. The study showed that farmers after joining the seed producers' association increased use of improved farm in-puts, had a positive change in household welfare and acquisition of fixed assets. The experience from Uganda to engage smallholders to produce and distribute quality seed is not only a case of farmers willing to pay for seed potato but a demonstration of their willingness even to pay for quality control services. These achievements however were made partly due to the profitability of the seed potato enterprise, logistical and technical support, consistent farmer-change agent feedback and expert farmer training in seed potato enterprise management.

Keywords: Clean seed, quality declared seed, seed producers' association.

TH2ABS221

Potato seed certification in Kenya, prospects, achievements and constraints

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Abstract
Potato (*Solanum tuberosum* L.) is a crop of major economic importance worldwide and is considered the second most important food crop after maize in Kenya. National potato production ranges from 4.4t ha^{-1} to 15t ha^{-1} with an average of about 6.7t ha^{-1} although yields of 40t ha^{-1} are attainable under research conditions. The low yields are attributed to production constraints such as low soil fertility, diseases and the unavailability and high cost of inputs mainly certified seed tubers. Improving the availability of certified disease free potato seed of high varietal purity is therefore of paramount importance in ensuring optimum ware potato production. KEPHIS has supported the implementations of various interventions aimed at alleviating constraints in the seed supply system. These include seed certification, quality assurance of seed emanating from new technologies such as aeroponics, phytosanitary certification of approved seed imports from Europe and adoption of modern techniques such as PCR for seed health testing. Also, for the first time in over 20 years, Kenya's farmers are set to benefit from superior seed potato varieties imported from the

Netherlands. Together with the recently released varieties bred by KARI and CIP, farmers will now have a wider range of potato varieties to choose from

Key words: Potato, Seed certification, Phytosanitary regulation, quarantine

TH2ABS203

Potato virus Y in South Africa: Isolate characterization and assessment of potato cultivar resistance

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Abstract
Potato Virus Y (PVY) is one of the most serious viral threats to potato production worldwide and throughout Africa resulting in severe crop yield reduction. Management of this virus is therefore key to sustainable potato production. The virus is transmitted by infected tuber material and by aphid vectors. In South Africa (SA), the pathology of PVY infections has changed in recent years. Disease diagnosis based on leaf symptoms became problematic, and elimination of the disease by means of the SA Certification Scheme based on ELISA testing was the only way to diagnose and eliminate diseased mother tuber material. The PVY^{NTN} strain has recently been found in South Africa which can cause potato necrotic ringspot disease (PTNRD) and this can lead to crop failure as tubers showing necrosis are unacceptable to the consumer. The principle objectives of this study were to characterize the PVY strains which are currently responsible for infections in South Africa and to determine the resistance of locally plant potato cultivars to these PVY isolates. Using whole genome sequencing and a novel approach to the phylogenetic analysis of these sequence data, we were able to determine that the older PVY ordinary (PVY^{O}) and PVY necrotic (PVY^{N}) strains had largely been replaced by $PVY^{N\text{-}Wilga}$ and PVY^{NTN} strains since 1995. Presently, approximately 75% of the PVY isolates in South Africa are of the $PVY^{N\text{-}Wilga}$ and PVY^{NTN} strains. To determine the resistance of potato cultivars commonly planted in South Africa against our local $PVY^{N\text{-}Wilga}$ and PVY^{NTN} isolates, we assessed the speed of viral spread of selected isolates using the Reverse Transcriptase Polymerase Chain Reaction (RTPCR) in mechanically infected potato plants. Tubers were also assessed for necrotic symptoms. This has shown that some cultivars show higher levels of resistance to PVY infection. The assessment of the resistance of potato cultivars is conducted on an ongoing basis and the results of our assessments to date will be presented. Management of PVY in South Africa will in future be based on ongoing monitoring of PVY isolate mutation and recombination through whole genome sequencing and planting of PVY resistant cultivars. Furthermore vector control by chemical means and planting during cooler seasons when aphid pressure is lower, and elimination of infected tubers by means of the certification scheme will together be used in a strategy to reduce the effects of PVY infections.

TH2ABS075

Potato yield variation as affected by viruses seed degeneration and growth conditions in Tunisia

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Abstract
Viral diseases mainly affect crop growth by reducing the size of the canopy, thus inhibiting the interaction of the incoming solar radiation. Additional yield reduction may be caused by effects on the radiation use efficiency or on the dry matter allocation to the tubers. Research plots were established in 2012 at the Ariana Research Station (INRAT) to determine the effect of seed born PVY and poor growing conditions on yield of cv Spunta (fairly good resistance to virus PVY^{n}) during spring crop season (February-June). Five potato seed origins were evaluated. They have five levels of PVY infection: 0%, 2%, 4%, 8% and 50%. They were grown under poor conditions: 50% of the normal fertilization doses, 0% added organic matter and high water salinity (around 4g/liter). The results showed significant general effects of the poor growing conditions on yield reduction whatever the infection level. The differences between yield origins were statistically significant and yields were negatively affected at 8% and 50% infection levels. Thus, the PVY infection levels have a negative effect on yield losses under poor crop management. These findings confirm the previous results recorded in 2007 season crop. Useful applications in the Tunisian National seed program were proposed and applied.

TH2ABS051

Potential of an improved thermotherapy treatment in improving the potato (*Solanum tuberosum* L.) seed system in Malawi

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Abstract
The potato industry in Malawi is constrained because its seed system is informal. Farmers usually use the conventional method by saving stock from previous harvest which leads to poor quality planting materials, hence reducing yields and quality. Access to pathogen free seed remains a big challenge. A study was conducted to determine the optimum heat period regimes for eliminating pathogens and potential of clonal multiplication for different local potato genotypes by improvising thermotherapy chamber conditions through use of low cost materials. A factorial experiment was laid out in a Completely Randomized Design (CRD) with two factors; genotypes-*Magalabada*, *Rosita* and *Usiwawatha* and Heat Period Regimes-

3, 5 and 7 weeks in a tissue culture laboratory at Bunda College, Malawi from August to December, 2011. The potato plantlets that were cultured on Murashige and Skoog (MS) media (after three weeks of incubation) were placed on a bench containing four fluorescent bulbs (Phillips) providing 5000 lux each and were covered with a black plastic paper and black flannel cloth. This produced temperature ranges of 24-28°C during night period and 28-38°C during light period (16 hours photoperiod). The Double Antibody Sandwich Elisa Kit was used to analyze presence of pathogens from mother stocks (tubers) and the cleaned plantlets (plantlets that had undergone thermotherapy). DAS-ELISA kit results tested positive for *Ralstonia solanecearum*, PVA, PVY, PVM, PVX, PVS and PLRV in the mother stock tubers at different incidences and intensities for all genotypes. For the developed plantlets, There were significant differences for the chance of success ($P<0.05$) for bacterial wilt, PLRV, PVA, PVM, PVY and PVX loads to be reduced by thermotherapy treatment exposure period independently, but for PVS, there were significant differences ($P<0.05$) in the genotypes only. Plantlets grew to a height of 3 cm and had 8 nodes. Genotype *Rosita* exposed to heat for 3 weeks had good vigour at ($P<0.001$). It is better to subject potato plantlets to heat for 3 weeks to obtain pathogen free plantlets with good clonal multiplication potential and subjecting them for over 3 weeks to eliminate the pathogens. The findings imply that this improvised thermotherapy treatment can be used for both reduction of pathogens and seed multiplication programmes by research institutions to provide farmers with clean seed for improved yields.

Key words: potato, seed, thermotherapy treatment, improvise, tuber, plantlets

TH2ABS034

Progress in establishment of an *in vitro* potato (*Solanum tuberosum* L.) germplasm collection in Kenya

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Abstract

The potato (*Solanum tuberosum*) industry in Kenya demands that varieties be readily available for further multiplication when required. Potato is vegetatively propagated from tubers. Conservation and maintenance of potato germplasm in field repositories is however, cumbersome, expensive and laborious. The germplasm must be re-planted after every season and accessions are exposed to hazards such as outbreaks of pests, diseases, drought and other vagaries of nature. Field maintained collections are known to contain a large amount of viral contamination which severely reduces yields. *In vitro* conservation methods such as slow growth, alginate encapsulation and cryopreservation have been developed in recent times whereby a nucleus set of disease-free and true to type cultivars are conserved to ensure regular supply of disease-free planting material to the industry. These methods have several advantages over field repositories including: safety and efficiency in distribution of potato germplasm; easy availability of cultivars for micropropagation; minimizing the transfer of major pests and pathogens; permitting virus eradication through meristem culture; and avoidance of exposure of germplasm to environmental disturbances such as drought and hailstorms. This paper reports on the progress that has been made in establishment of an *in vitro* cultivar collection by the national

potato programme at Kenya Agricultural Research Institute, Tigoni centre. It also describes the procedures that are used for *in vitro* conservation in which 40 potato accessions have been conserved so far. Some of the challenges experienced and approaches to improve efficiency in the conservation of potato cultivars are also presented.

Key words: *in vitro* conservation, field repositories, potato, disease free.

TH3ABS020

Progress towards genetic transformation of Ugandan sweetpotato cultivars for weevil resistance

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Abstract
Sweetpotato (*Ipomoea batatas* (L.) Lam.) has high potential to reduce hunger and malnutrition in sub-Saharan Africa since it gives better yield with few inputs. However, the potential production of the crop in Africa is not attained due to various challenges, including severe viral diseases and increasing attacks by sweetpotato weevils (SPW). Effective resistance to SPW has not been identified in the sweetpotato gene pool. On the other hand the *cry7Aa1* and *cry3Ca1* genes have been assembled into a plasmid vector for use in genetic transformation. The proteins translated from these genes showed effective resistance to *Cylas puncticollis* and *C. brunneus* in artificial diets. The parameters for efficient transfer of these genes and the conditions for *de novo* regeneration from stem internode explants which were optimised in preliminary studies were used in the *Agrobacterium*-mediated genetic transformation of Ugandan landrace 'Kyebandula' with *cry7Aa1* and *cry3Ca1* genes. Fifty-four per cent explants formed adventitious buds, a mean of 7 buds were formed per explant, 6.0% explants formed shoots with a mean of one shoot per explant for those explants that formed shoots on medium containing 50 mg/L kanamycin as a selection agent. Preliminary analysis with PCR using primers for *cry7Aa1* showed that the transformation efficiency could be as high as 2%. The use of meristems as explants has recently shown the possibility of improving the transformation efficiency. These data highlight the potential of genetic transformation in transferring weevil-resistance genes and paves the way for enhancement of food security.

Key words: *Bt* crops, genetic transformation, sweetpotato, weevil resistance

TH2ABS151

Public-private partnerships supporting women-driven potato seed multiplication in the Lumwana catchment area of north-western province of Zambia

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Abstract
The opening of new mines and associated population boom is contributing to the increase in potato (*Solanum tuberosum* L.) consumption, which calls for increased production of the crop in Northwestern Province of Zambia. However, one of the Major constraints hampering expansion of potato production in the region is lack of seed for improved varieties. Apparently none of the seed companies is engaged in potato seed production in Zambia. All improved seed is imported from South Africa and Europe either in form of botanical seed or "seed potatoes" and is not adequately available to guarantee year round production of the crop by small scale farmers in the province. The local potatoes generally produced by local farmers are not good for chips because of size and shapes, and are of short shelf life. In response to the national government's strategic plan of fostering development of the agricultural sector through the establishment of public-private partnerships in Zambia, the Lumwana Copper Mining Company under Barrick Lumwana, Mutanda Research Station under the Zambia Agriculture Research Institute (ZARI), and the department of Field Services and Extension of the Ministry of Agriculture and Livestock, are working in partnership to support farmer-driven seed multiplication and year round market-oriented production of potatoes in the Lumwana catchment area. Barrick Lumwana provides start-up funds for the projects, while ZARI and extension front line agents are responsible for training and provision of technical backstopping to the women farmer groups in the project. Primary aeroponic-based seed multiplication of most preferred and highly marked improved varieties of potato is conducted by ZARI at Mutanda Research Station which generatesclean seed that is distributed to women-managed secondary seed multiplication sites. Six selected women groups have been trained and are able to attain a 1:15 multiplication ratio of quality declared seed from rain-fed upland and off-season wetland nurseries, which in turn, is distributed to group members for commercial production and marketing. The women producers are also linked to the market by the business and agriculture development department under the Lumwana Mining Company. This paper shares the experience, successes and challenges encountered in the implementation of a women-driven seed multiplication and distribution project, which is a unique example of the social corporate responsibility whereby the private mining industry is "turning stones into bread" by ploughing back the proceeds from the minerals into agriculture.

Keyword: *Potato, Multiplication, Public-private partnerships, Women-driven, Lumwana, ZARI*

TH2ABS052

Quality seed potato key to improved livelihoods; the evolutionary process: a case for Uganda.

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Abstract

Solanum tuberosum plays a major role in national income, food and nutritional security. Potato is grown by 300,000 smallholder households in Uganda that produce 689,000 tons on 101,000 hectares per year. The major production areas are the highlands of southwestern and eastern Uganda. Potato production in Uganda has gone through evolutionary changes in terms of area under production and production techniques in order to get the seed system moving. The conventional method of seed potato production involved open field bulking. The number of multiplication cycles was five times to generate 40-50 tonnes of seed potato for selling to farmers. It involved rare importation of minitubers. In 1996 a private sector association (Uganda National Seed Potato Producers Association – UNSPPA) was developed. This created demand for more quality seed potato and relieved KAZARDI of some generations of seed bulking. With funding from ASARECA under technology transfer project, farmers were trained on quality seed production from 1998 to -2001 Farmer field school introduced the aspect of field inspection and farmer training (1999-2002). The capacity of national potato programme was boosted with a fully operational tissue culture laboratory in 2007 This enhanced mass production of quality planting materials, minimized transmission of diseases, and maintained varieties in a disease free state. In 2009 with USAID funding and technical support from the International Potato Centre, high through output aeroponics technology was introduced and this enormously accelerated minituber production. Aeroponics produced more yields of about ten times higher than conventional tissue culture more quickly and at a less cost. From stem cuttings, the mean number of tubers for Victoria is four, conventional tissue culture seven and aeroponics forty. This suggests progressive increase in pre-basic seed production and the resultant basic seed quantities given out to commercial seed producers presently.

Key words: Seed potato, stem cuttings, tissue culture, aeroponics, tuber productivity, capacity building

TH2ABS044

Quality seed potato production: experiences from the highlands of Ethiopia

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Abstract

Utilization of clean seed is a key factor to improve potato yields and reduce the dissemination of pests and diseases. Decentralized, community-based seed production schemes have been established since 2008 in 22 highland districts of Ethiopia. Clean seed potatoes of selected improved varieties were multiplied on station and distributed to more than 120 seed producer cooperatives located in major seed producing areas. More than 9,000 seed potato growers were trained on clean potato seed production and post-harvest management. In addition, more than 980 development agents from the ministry of agriculture were trained in advanced seed potato production and management to give technical backstopping to the trained seed farmers. To ensure formation of multiple sturdy and green sprouts that constitute aspects of quality seed and increase the seed storage capacity of seed farmers, approximately 750 diffused light stores with a total capacity of 5,000 tons were constructed, mostly using farmers' resources. In 2012, a total of 6,000 tons of quality seed was produced by trained seed potato growers and sold to other seed and ware potato growers in different parts of the country. The use of clean seed of the improved varieties and appropriate agronomic techniques enabled members of the seed producer cooperatives to obtain yields of 21 t/ha which can be considered significant compared to the national average yield of 8 t/ha. Experiences to date indicate that training of farmers on the use of healthy seed tubers and integrated crop management is crucial for keeping seed potato healthy. Further capacity building at cooperative level is needed to strengthen business and leadership skills of farmer cooperatives and create small-scale, self-sustained seed production enterprises. To ensure that the minimum seed quality standards are maintained an informal seed inspection system that applies the concept of quality declared seed is currently being piloted.

Key words: Clean seed, community-based seed production, capacity building, cooperatives, Diffused light store

TH2ABS094

Reducing infection rates of potato viruses PVY, PLRV and PVX by positive selection in three Kenyan potato varieties

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Abstract
Selecting seed potatoes from healthy-looking mother plants (positive selection) was compared with common Kenyan farmer practice of selection from the harvested bulk of potatoes (farmer selection) in 23 farmer-managed trials. Data was obtained from replicated researcher managed and farmer managed trials comparing positive selection with seed recycling, which is a common farmer practice in Kenya. Virus incidence levels were scored through DAS-ELISAo. The effect of positive selection on yield and virus incidence was investigated, and analyses on the relation between virus incidence and yield performed. Positive selection assured lower incidences of PLRV (39%), PVY (35%) and PVX (35%) and out yielded farmer selection irrespective of the agro-ecology, crop management, soil fertility, variety and quality of the starter seed, with an overall average of 30%. Regression analysis showed a relation between lower virus incidence and higher yield for the varieties. The result from this research has conclusively shown that positive selection is a suitable practice for seed potato quality maintenance which can benefit all smallholder potato producers who at some stage select seed potatoes from their own fields, and should thus be incorporated routinely in agricultural extension efforts. Targeted controlled research to investigate such additional factors would increase the understanding of the mechanisms behind positive selection. A remaining topic of interest for further research is the development of the yield potential of potato crops under positive selection over several generations. Current seed potato system management decisions are based on the assumption that degeneration as a result of tuber-borne diseases is an inevitable fact, and that regular seed renewal from a reliable disease-free source is the only manner to maintain an acceptable yield potential. This research has shown that positive selection assists in managing virus infection levels. It would be of interest to witness potato yields over several generations of applying positive selection to a degenerated potato crop. This would allow one to challenge the common belief that degeneration is inevitable and irreversible in a potato population. It could be hypothesized that opposed to degeneration of a potato plant population over generations, also regeneration needs to be considered as an option, provided ware potato farmers manage their selection process well.

Keywords: *Potato, "Positive seed potato selection, PLRV, PVY, PVX*

TH2ABS179

Sand hydroponics: An alternative technology for pre basic potato seed production

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Abstract

After the global phasing out of Methyl bromide, conventional systems for seed potato production started to have serious problems for substrate sterilization. New techniques were proposed to overcome these difficulties. Hydroponic techniques including aeroponics have shown great productivity rates. Aeroponics technology introduced in SSA through the 3G project revolutionized basic seed potato production in SSA. However, this technology requires constant supply of electricity and specialized attendants over the growing period. In many SSA countries there is infrastructural challenge, particularly unreliable supply of electricity and expensive boiler based sterilization methods for the growing media. Sand hydroponics is a mixture between fertigation and hydroponics. It uses sand as the inert material and an elevated tank to allow the flow of nutrients solution by gravity. Sand is sterilized with sodium hypochlorite (bleach) and rinsed with water. Then sand can be placed in beds, crates or pots. Plant materials can either be *in vitro* plants or small minituber sprouts devoid of the mother tuber. Minitubers produced through aeroponic which are too small to plant in the field can best be further multiplied in sand aeroponics. Production rates are better than those achieved through the conventional system, but less than aeroponics. Peruvian cultivars Canchan and Serranita yielded on average 364 and 240 mini tubers/m^2 respectively with an average weight of 35.8 kg and 17.8 kg/m^2, using bed sand hydroponics. At Tigoni in Kenya yields of 450 minitubers have realized from 1m^2 of planted area.The main advantage obtained is the production of bigger size mini tubers that can be further cut into smaller seed pieces with a minimum of 2 sprouts each. This, we can increase the production to over 500 seed tubers/m^2, which is a clear advantage over the conventional system. Seven modules are presently installed in Peru and 5 in SSA countries that include Kenya, Tanzania, Uganda, Ethiopia and Malawi. The initial cost and cost per season of sand hydroponics is lower than the conventional system and aeroponics. In the future we believe sand hydroponics should replace the conventional system for quality seed potato production in the greenhouse.

TH2ABS081

Seasonal effects on potato production under conventional and small seed plot technologies in the Mt. Elgon zone

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Abstract

Potato production in the Mt. Elgon zone of Uganda is constrained by seasonal variations, lack of clean seed, pests and diseases. Consequently, yields hardly exceed 2.9 tha^{-1} yet a potential of 10 tha^{-1} exists. This study was conducted to determine the effect of seasons and the small seed plots in enhancing seed potato production in the Mt. Elgon zone. On-farm trials were conducted in Bududa, Sironko, Manafwa, Kapchorwa and Kween districts in the first and second seasons of 2011. Results showed higher potato yield in Kapchorwa and Kween in the second season compared to the other districts. The number of tubers was higher in small seed plots than conventional potato planting with significant effects ($P \leq 0.05$) in Bududa and Kapchorwa. The number of tubers with bacterial wilt was higher in conventional potato planting than the small seed plots, with Manafwa and Sironko registering the highest incidence. Though bacterial wilt and late blight incidence was not significantly different in the two seasons, infected tubers for both pathogens were more in Manafwa and Sironko for bacterial wilt, and Bududa and Kapchorwa for late blight. Principal component analysis revealed tuber numbers and potato tuber moth damage to be more associated with environment in Kween. Therefore, potato productivity in the Mt. Elgon zone is higher in the second season, with the small seed plot technology being favourable for small land holdings than conventional potato planting.

Key words: Bacterial wilt, conventional potato planting, late blight, seed potato, small seed plot technology

TH2ABS166

Seed potato production systems that relate to the highlands of Africa

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Abstract

Seed potato production systems from tropical highlands of Asia that relate to the highland regions of Africa from 25 N to 25 S latitude at elevations of 1500 – 3000 m asl will be discussed in this presentation. From the perspective of 30 years of experience, key ingredients for excellent seed systems have been developed. The seed system needs to be informal and tailored to the needs of and financial capabilities of various sized commercial growers. The merits of quality seed will depend on the yield expectation of the commercial grower. The higher the yield expectation, the greater the demand for quality seed. The seed system needs to have high quality at the first multiplications. This is particularly true for seed free of bacterial wilt, ring rot and PSTV. Tissue culture material should be the starting point. The number of multiplications should not exceed three. New varieties for which there is high demand and no seed readily available are an essential ingredient of the seed system. Any new variety will need to have several outstanding secondary traits including virus resistance and good consumer acceptance along with a suitable tuber dormancy period which will depend on the cropping system of the area. Continuous on-farm trials are needed to verify and demonstrate the merits of improved seed and also determine how many generations the seed can be replanted with the use of positive and negative selection as well as no selection. Public support for maintaining the disease free material of the varieties to be multiplied is important. The whole seed system should be a profitable business for all players involved. Examples will include success and failure stories from the tropical

highlands of the Philippines, Vietnam and SW China. In all cases the seed system developed due to the availability of new varieties with superior yield, eating quality and durable late blight resistance for which there was no traditional seed source. It is the authors' desire that these lessons learned from the Asian story will be relevant to the African story and useful in policy development and getting the African seed potato systems moving.

Key words: informal, degeneration, profitable, tissue culture, seed production.

TH2ABS088

Shortage of sweetpotato planting material caused by pro-longed dry seasons in Africa: strategies to increase its availability in Uganda

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Abstract

Farmers in Bukedea and Soroti districts in Uganda normally experience 3 – 4 months of dry weather between mid-November and March. During the dry period, vegetation of the sweetpotato crop is completely desiccated, leading to difficulties in securing vines as planting material at the onset of the rains. Failure to plant results in lack of food for vulnerable farming families, particularly before the grain harvest. The objectives of the study were to understand in-depth the lack of planting material; test if it is possible to increase the amount of planting material by using fertilizer to increase the production of vines in the limited swampy areas available and to extend its use by rational planting approaches to produce ware roots. Farmer interviews were administered in 2008 towards the end of the dry season with total 44, 72, 105 and 50 farmers from Mukono, Kamuli, Bukedea and Soroti, respectively. On-farm trials on increasing production of vines; compared the use of mini cuttings (10 cm; 2-3 nodes), recommended by scientists, against the farmers' preferred vine length of 20 cm. Planting material was conserved and multiplied using NPK (25:5:5) fertilizer applied at 100g/m^2 of propagation beds. On-farm trial on extending area planted using the available vines involved shortening vines planted and reducing plant densities for production of roots was trialled during the second 'short' rains of 2008 and 2009.The treatments were replicated 3 times and allocated to individual plots in a complete randomized block design. About 58% of the farmers interviewed in Soroti reported failure to plant due to lack of planting material. Doubling the length of mini-cuttings significantly (P <0. 001) increased the number of normal (30-cm long) cuttings harvested from the high density vine beds. Pre-planting fertilizer application doubled the harvested number of cuttings. Shortening the normal vine length (30-cm long) planted by a third and reducing the plant densities from 3 plants per m^2 to 2 plants m^2 did not significantly (P> 0.05) affect the yield of ware roots. Further studies are needed to verify the optimum fertiliser usage.

Key words: Sweetpotato, Uganda, vines, shortage, strategies, conservation, multiplication

TH2ABS062

Strategies to enhance community-based sweetpotato seed systems for sustainable livelihoods in Odisha, India

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Abstract
Sweetpotato is an important crop grown under rain-fed conditions and largely consumed in Odisha state of east India. Odisha's total sweetpotato production is highest in the country but its productivity (t/ha) is low. Availability of quality planting material on sustainable basis is a major challenge for the farming communities. Though the supply network of quality of planting material from research stations to farmer's fields are in place, strategies need to be worked out to make quality planting material available throughout the year in the farming conditions. Setting up community managed nurseries; including knowledge on rapid multiplication techniques and quality maintenance of planting materials are the key for sustainability. Nurseries established in the vicinity of farm areas could provide timely and adequate supply of planting materials to the local community. To ensure sustainability of nursery operations, certain mechanisms had been introduced for farmers to "pay back" planting materials either in cash or in kind (vines/roots). Necessary nursery/multiplication technologies could be imparted to conserve the useful planting material during unfavorable climatic conditions and off season. Swamps, low lands, canal irrigated sites with assured irrigation, shady places, multiplication through intercropping with mango, coconut, oil palm and cashew crops were some of the strategies adopted to get seed systems going and availability throughout the year. Farmer–farmer approach and involvement of self-help groups help to initiate scaling-up operations for plant material production and improving local seed systems. Capacity building for sweetpotato vine multipliers, and village nurseries established will ensure supply of quality planting material for further expansion of sweetpotato production. State owned horticulture department farms, research stations, farmer science centers, river and canal beds were considered to be places for conserving and multiplying planting material apart from the traditional nurseries. Commercial growers of sweetpotato sometimes depend on growing the sweetpotato planting material at some designated sites and transport them in bulk for planting in the main field. However, small farmers rely on retaining the plant material in small quantity nearer to the households or depend on farmer-farmer approach. Home garden concept integrating with other vegetables either for multiplication or for production proved to be one of the viable methods for income generation and sustainable production.

TH2ABS170

Sweetpotato feathery mottle virus: the major limiting virus in the sweetpotato virus complex disease in farmers' fields in Uganda

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Abstract
Sweetpotato virus disease (SPVD) is caused by the co-infection of sweetpotato plants by *Sweetpotato chlorotic stunt crinivirus* (SPCSV) and *Sweetpotato feathery mottle potyvirus* (SPFMV). The co-infection of SPCSV with other viruses like Sweetpotato Mild Mottle Ipomovirus (SPMMV) and Sweetpotato Chlorotic Fleck Carlavirus (SPCFV) can also result in symptoms similar to SPVD including yield reductions (>58%). Farmers inadvertently perpetuate SPVD causing viruses, and hence SPVD, through selection of healthy looking vines as the source of their planting material that could be singly infected by viruses. The aim of this study was to establish the most limiting virus, at farm level, in the development of SPVD. Serological assays were conducted for the four major sweetpotato viruses in Uganda on healthy looking plants sampled from farmers' fields and those from a field that was planted with virus-free vines at Makerere University Agricultural Research Institute, Kabanyolo. ELISA results were confirmed with RT-PCR using virus-specific primers. Over 97% of the healthy looking plants sampled from farmers fields in the central Uganda district of Wakiso were positive for at least one of the four viruses tested. SPCSV had the highest incidence (70.1%) followed by SPFMV (12.0%) and the co-infection of SPCSV+SPFMV (8.3%). Other virus(es) detected include SPCSV+SPMMV (1. 7%), SPFMV+SPMMV (1.5%), SPCFV (1.1%), SPCSV+SPCFV (0.5%) and SPMMV (0.5%). However, five months after planting virus-free vines in the field, only 0.8 and 3.2% of the plants tested positive for the whitefly-borne SPMMV and SPCSV, respectively, probably due to vector mediated re-infection. The aphid-borne SPFMV spread rapidly (>72%) into the experimental field probably from some alternate hosts. It was interesting to note that SPCSV was the most prevalent virus in healthy looking vines yet it exhibited very low re-infection rates. These observations suggest SPFMV to be the most limiting virus in the development of SPVD in farmers' fields. Therefore, looking out for alternate hosts for SPFMV in the vicinity of sweetpotato fields could greatly enhance management of SPVD.

Key words: *Ipomoea batatas*; Latent infection; Planting material; Virus re-infection.

TH2ABS070

Sweetpotato cultivar degeneration rate under high and low sweetpotato virus disease pressure zones in Uganda

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Abstract
Sweetpotato is a vegetatively propagated crop where vine cuttings from previous crops or volunteer plants are used as planting material. This practice leads to the accumulation of systemic pathogens especially viruses, resulting into the devastating sweetpotato virus disease (SPVD). The contribution of this practice to degeneration of sweetpotato cultivars in Uganda has so far only been speculative. The aim of this study was to document the rate of sweetpotato cultivar degeneration in high and low SPVD pressure zones of central and eastern Uganda. Virus free planting material of sweetpotato cultivars, Beauregard, Dimbuka, Ejumula and Naspot 1, were established in field trials using completely randomized block designs at Kabanyolo (Central Uganda) and Serere (Eastern Uganda) for four growing seasons. Season 1 consisted only of virus free cuttings from an insect proof screen house (G1), season 2 consisted of G1 and cuttings from the plots exposed one generation in the field (G2), season 3 consisted of G1, G2 and cutting exposed in the field for two generations (G3), and season four consisted of G1, G3 and cutting exposed in the field for three generations (G4). Virus incidence and symptom severity were recorded monthly for four months after planting and NCM ELISA was used to identify the viruses. Data on total yield, marketable yield, total root number and marketable root number were taken at five months. Virus symptoms were observed in the field as early as one month after planting in all the generations. Higher disease incidence (10-100)% and severity score (2-5) were recorded on cvs Beauregard and Ejumula with all the Beauregard collapsing after one season in both locations. SPFMV and SPCSV were more prevalent in G3 and G4 than in G1. Viruses, C6 (1.3%), SPMSV (4%) CMV (1%) and SPCV (4%) were detected in combination with SPVD but at much lower frequencies. Total storage root yields, marketable yields and marketable number of storage roots were higher in G1 as compared to G2, G3 and G4 in Dimbuka, Ejumula and Naspot 1. Cultivars Beauregard and Ejumula expressed high levels of susceptibility, requiring healthy planting material each season especially in high disease pressure zone.

TH2ABS066

Table sugar as an alternative low cost carbon sources for *in vitro* Micro-propagation of orange fleshed sweetpotato (*Ipomoea batatas L*)

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Abstract

Tissue culture is becoming an integral part of orange-fleshed sweetpotato clean planting material production and conservation. However, in many developing countries, the cost of micro-propagation media is a major factor which precludes the adoption of the technology to suit large-scale commercial propagation. The aim of this research was to evaluate an alternative cheap carbon source and optimize the strength of MS (Murashige and Skoog, 1962) salt in sweetpotato micro-propagation media. The different media were prepared from a combination of two carbon sources (laboratory grade sucrose and table sugar) each with various concentrations (3% (w/v), 2 % (w/v), 1.5 % (w/v), 0.75 % (w/v)) and two levels of MS salt (full or half). After the plantlets had grown for 35 days *in vitro*, data on growth performance parameters such as number of regenerated plant, shoot/root biomass, shoot length and diameter as well as leaf number and rate of outside acclimatization were recorded. The result of all the measured parameters did not show significant differences between laboratory grade sucrose and table sugar as well as between half strength and full strength MS salts. However, lowering the concentration of both table sugar and laboratory sucrose below 2% (w/v) produced poor quality plantlets. The result also showed that up to 68% of cost reduction could be achieved by substituting the 3% (w/v) laboratory sucrose with 3% (w/v) table sugar and the full strength MS salt with half strength MS salt. It is recommended therefore that the 3% (w/v) laboratory sucrose and full strength MS which is used in the conventional sweetpotato micro-propagation medium can be replaced by 3% (w/v) table sugar and half strength MS, respectively. The findings of this study will have an important contribution in reducing the cost of sweetpotato micro-propagation thereby fostering the adoption of tissue culture in developing countries.

Keywords: Table sugar, micro-propagation, orange-fleshed sweetpotato, sucrose, Murashige and Skoog, Coast

TH2ABS095

The '3G seed potato revolution" a strategy to overcome the shortage of quality seed potatoes in Eastern Africa- experience from interventions in Kenya

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Abstract

One of the main reasons for the low potato yield is the use of poor quality seed potato. Currently the formal seed system is only able to supply less than 1% of the country's demand and on-farm management of seed borne diseases is hardly practiced. To increase the availability of high grade seed potato, CIP together with its national partners in Kenya, Rwanda and Uganda implemented in a USAID funded project an innovative seed strategy which lowers the cost of quality seed potato and is coupled with extension based interventions to train smallholders in better on-farm management of their farm saved seed. Engagement with the private sector as a means to widen the supply base and satisfy demand for quality seed is also a key component of the strategy. The strategy, named "3G seed potato", involves delivering low cost, quality seed to growers in 2-4 field generations, rather than the conventional 6 to 7 generations. The "3G" seed strategy envisages producing large numbers of minitubers through one generation of a very rapid multiplication technology (RMT) thus allowing bulking of sufficient seed in reduced number of field generations. This reduces both the cost of production and prevents the buildup of damaging diseases in the field. Partners successfully introduced, adapted, and adopted rapid multiplication technologies (RMTs), including the use of aeroponics to produce minitubers. This attracted the private sector and significantly increased the production of minitubers at national and regional scales. In Kenya alone, minituber production increased from 30,000 to 1,000,000 in 2.5 years. Within the 3G project, basic and certified seed production rose significantly—from 200 MT (average 2005–2009) to an estimated 4,000 MT per year, mainly due to private sector seed multipliers. This represented an increase in the availability of certified seed from about 0.06% to about 1.25% within just two years. Out of the produced 3G seed a considerable part was further multiplied by trained multipliers in the 20 main potato-growing districts of Kenya to make seed available locally to ware potato farmers. The targeted training of farmers was pivotal to the successful adoption and recognition of the importance of quality seed. The 3G project demonstrated that commercial producers and entrepreneurs, often engaged with other crops, can acquire the exacting technical skills required to produce quality seed potato and increasing the quality seed potato availability on a national scale.

Keywords: Potato, "3G seed potato", rapid multiplication technologies

TH2ABS050

Up scaling the adoption of positive selection and seed plot techniques in seed potato systems in Uganda -UNSPPA's experience

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Abstract
Accessing quality seed potato by smallholder farmers has continued to be a major challenge to increased potato production. To contribute to alleviation of this, the Uganda National Seed Potato Producers Association (UNSPPA) with support from ASARECA, CIP and NARO took an initiative to promote adoption of positive selection (PS) and seed plot techniques (SPT) in South Western Uganda which is a major potato production zone in the country. Although UNSPPA is engaged in commercial production of seed, this is not adequate and consequently it encourages smallholder farmers who can produce their seed and demonstrates the advantage of using clean seed in potato production. Using positive selection approach, healthy looking and vigorous plants are marked with a peg of tied with yellow thread. The marked plants are observed through the cropping season. Those that get sick are removed while healthy ones serve as mother plants for seed potato to be used the following season. In a participatory approach with farmers, trials comparing PS and seed obtained by farmer practice are demonstrated. Using PS, an increase of 34% or 3t/ha was recorded. This provides an economic gain with minimal, or no increase in cash investment. In another approach called the seed-plot technique (SPT) which entails growing small quantities of high quality seed under intensive management on raised beds at close spacing was on-farm demonstrated in participatory experiments involving researchers, development agents and farmers. Validations indicate that SPT achieved 2.5 to 3 times land productivity and about 50% bacterial wilt reduction compared to conventional ridge planting. 5890 farmers form South western Uganda were reached under different programs supported by ASARECA, CIP, CARE EEEGL, NAADS and NARO out of which 80% have adopted the technologies. It was revealed that such simple technologies can enhance the quality of seed potato used by smallholder farmers every season. It was further shown that, technology adoption was achieved faster through stakeholder participatory experimentation and group learning. These are some of the simple aspects that can be used to enhance technology uptake.

TH2ABS073

Validating and adapting small seed plot technology in quality seed potato production for smallholder farmers in Tanzania

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Abstract

Insufficient quality seed is a bottleneck in potato production among smallholder farmers particularly in sub-Saharan Africa. The problem is serious in potato producing areas of Tanzania due to absence of an organized seed potato system. Consequently farmers resort to using home-saved seed. This practice results in reduced growth, potato yield and quality due to accumulation of degenerative diseases. One way solving this is to introduce cheap but cost effective techniques for improving seed quality and quantity at farmer level. This can be partly achieved by developing and adapting technologies such as the small seed potato technique (SSPT) for production of quality seed. However, before such a technology is introduced, it needs to be tested for validity and agronomic requirements. Consequently, an experiment was conducted at ARI Uyole, Mbeya Tanzania to determine the optimum seed spacing at planting that would offer the highest tuber yield per unit area and seed-sets planted in small raised seed beds called small seed plots. Three potato varieties; Asante, Meru and Sherekea were planted at 15 cm x 15 cm, 20 cm x 20 cm and 30 cm x 30 cm in factorial arrangement with three replications. The number of tubers harvested per plant and m^{-3} of soil, and mean tuber weight (g) were all significantly ($P \leq 0.05$) influenced by seed spacing but not potato variety or interaction between the two factors. Significantly ($P \leq 0.05$) more tubers per plant were obtained at 30 cm than at 20 and 15 cm spacing. However, there was no significant ($P \leq 0.05$) difference in number of tubers harvested per plant at 15 and 20 cm spacing. The average tuber weight was significantly ($P \leq 0.05$) higher at 30 than 20 and 15 cm spacing. The number of tubers per square metre was significantly ($P \leq 0.05$) higher at 15 and 20 cm spacing than at 30 cm, respectively. Similarly, more than twice the number of tubers was produced per square metre at 15 cm than at 30 cm spacing. Therefore, considering the intensive nature of SSPT, it is important to maximize productivity per unit area than producing large tubers obtained at wider spacing as long as the health of the seed is kept high. Additionally considering the bulk seed that may need to be transported, 15 cm spacing offers more and easily transportable seed tuber per unit area of SSP than at 20 and 30 cm spacing.

Keywords: *Quality seed, potato bacterial wilt, seed health management, home-saved seed*

TH2ABS015

Validation and dissemination of small seed plot technology for seed potato quality availability and maintenance in Burundi

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Abstract
Low availability of seed potato quality is the major constraint to the production of the crop in Burundi. Prevalence of diseases such as late blight (*Phytophthora infestans*), virus and bacterial wilt (*Ralstonia solanacearum*) contribute to the degeneration leading to low yield in the potato farming system. Improving the availability of seed potato in the small farmer was studied by testing, adapting and promoting the small seed plot technology in seed production that would reduce the accumulation of degenerative diseases in seed. This technology was evaluated in three provinces of the country that are Bururi, Kayanza and Bujumbura respectively in Buyengero Muruta and Mugongomanga communes during the long rain season in 2007. The technology was tested again with 32 associations of farmers during the second and the first rainy season of 2010 and 2011 respectively. Small size of pre-basic Seed potato, about of 30-35 mm in diameter, were planted with a spacing of 20 X 20 cm and 30 cm X 30 cm (respectively for the 2007 rainy season and the other seasons) in holes 15 cm deep beds of statements 9 m long and 1.8 m wide. This was compared with the same quantity of the same seed planted in 80 X 30 cm for a conventional method of planting in furrow planting potatoes. Mineral fertilizers were applied at 350 kg / ha NPK at the rate of 60: 90: 60 found in 200 kg of DAP, 100 kg KCl, 50 kg urea at planting. The incidence of bacterial during plant growth, tuber yield to maturity, and the perception of farmers in respect of technology were recorded. There was a difference between the small plots and conventional plots the total yield (t/ha), the number of tubers, number of harvested tubers per plant, and the average weight of tubers (g). The productivity of potato tubers harvested in terms of per unit area was higher for small parcels (76.5 tubers/m^2) than conventional plots (32.2 tubercules/m^2) ($P < 0.01$). Latent infection of late blight were significantly higher in small plots (22.1%) than the conventional plots (12.1%) ($P<0.001$). There was a significant difference ($P < 0.001$) in the average weight of tubers between the two techniques. The evaluation of the technology by farmers indicated a high advantage for small plots compared to conventional plots and one m^2 of small plot was sufficient to generate enough seeds to plant 30 m^2 plots in the conventional system. With knowledge and skills acquired through trainings, workshops and farmer field schools, majority of trained group members and other farmers in the community established their own small seed plots. NGOs and some CBOs were interested to the technology and some of them like CAPAD (CBOs), ACVE (Action Ceinture Verte pour l'Environnement) and ELVIA to disseminate in Mwaro province started yet to disseminate the technology.

Keywords: *bacterial wilt, conventional plot, small seed plot, seed potato*

TH2ABS024

Informal seed potato system in Nigeria: strategies for seed quality improvement

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Abstract
Nigeria has a land area of 92.4 million hectares and a population currently estimated at about 160 million with an annual growth rate of 2.5%. 30% (about 28 million ha) of the land can sustain economic production of the Potato. 300,000 hectares are currently under potato production most of which are on the Jos Plateau which accounts for over 90% of the production. The seed demand is about 600,000 tons per annum. The seed potato system in Nigeria is largely informal with all the typical informal features of integration, local organization, flexibility, and non regulation. Over 80% of the potato seed is supplied by the informal sector. The quality of seed in the informal sector is poor resulting in low yields of about 5-7t/ha compared to 15-25t/ha from clean seed. Strategies to improve seed quality include private sector driven importation, multiplication and distribution of clean seed; positive selection for farmers' own saved seed; and seed plot techniques. Implementation of these strategies is expected to improve the health status of seed in the informal system through injection of clean seed, and reduction in potato disease and pest buildup in farmers' own saved seed. This will increased ware potato yield and lead to improvement in livelihood of potato farmers.

Keywords: Seed potato, Informal seed system, Positive selection, Seed plot technique, Clean seed

TH2ABS039

An analysis of demand, supply and elasticities of seed potato in major producing areas in Nigeria

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Abstract
The study was conducted in 2012 to assess the influence of economic variables and prices of complementary and substitute products on the demand and supply of seed potato in major potato producing areas of Bokkos, B/ladi, Mangu, Jos south, Riyom and Jos north of Plateau state in Nigeria. Cross-sectional data on 90 each of seed potato producers and seed potato traders were collected through the administration of a questionnaire and by the use of multistage and random sampling techniques. Descriptive statistics and linear regression models were used in the analysis. The results show that farm size, income and education positively and significantly influence the demand for seed potato ($P<0.01$). Seed price however, negatively and significantly ($P<0.05$) influence the demand. On the supply side, results indicate that experience, gender and household size have a positive and significant ($P<0.05$) relationship with the value of seed potato supplied. The own price elasticity of demand and supply for seed potato were inelastic. The elasticities of the other variables in the demand and supply functions were also less than 1 (inelastic) except that of fertilizer. The price-cross elasticity for the demand of potato and other products were <1 and negative, while in the case of supply the cross-price elasticity was positive. From the results it is concluded that seed potato cultivation in the study area is increasing with increase in education and income of farmers. Unit changes in the significant factors influencing demand and supply contributed decimally to low shift in the demand and supply of seed potato since these factors are inelastic. This implies that in the long run changes in these factors will bring less than proportionate change in seed supply. This results call for policies that will provide support on pricing, regulate farm labour practices and improve access to mechanized labour, facilitate the importation of quality fertilizer and farm inputs, and provide functional education to farmers to applied modern knowledge in production and marketing.

TH2ABS056

Production of minitubers using stem cuttings in low and high light intensity greenhouse

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Abstract
Stem cutting propagation is among the most productive and highly efficient low cost potato rapid multiplication technique. An experiment was conducted at Kenya Agricultural Research Institute, Tigoni to determine the effect of light intensity on productivity of potato stem cuttings. The mother plants were originally tissue cultured and then raised in trays containing coco peat as the medium. The trays were placed in a greenhouse. When they were three weeks old, stem cuttings were made from them. The cuttings were planted in sandbeds. The sandbeds were placed in both 50% shaded and unshaded glasshouses. The 50% shading was achieved by placing a net over the greenhouse so that only 50% of the incident radiation passed through into the glasshouse. The experimental design was a split plot in which the five potato cultivars (Tigoni, Sherekea, K. Mpya, Dutch Robyjn and Purple Gold) were the main plots and the lighting (50% shaded and unshaded) were the subplots. The experiment was replicated three times while the subplot consisted of ten stem cuttings. After three months, minitubers were harvested from the stem cuttings. Data collected was the number of minitubers from the ten stem cuttings in each subplot. The data was analysed using Genstat version 12 and mean separation was done using Tukey's test at 5% level of significance. There were significant differences among the potato cultivars, between the lighting intensity and in the interaction between potato cultivars and lighting intensity. Kenya Mpya had the highest mean number of minitubers per plant (6) and (4) from the 50% shaded glasshouse and un-shaded glasshouse respectively. The shaded glasshouse gave the highest mean number of minitubers for all the cultivars. This suggests that low light intensity favours minituber production in potato stem cuttings. This could be due to a longer stay-green period that enhanced tuber initiation.

Keywords: Light intensity, Minituber, Stem cuttings

TH2ABS060

Improved methods and processes in the certification of seed potato for *Ralstonia solanacearum*

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Abstract
One of the main bottlenecks to the scaling-out of seed potato in Kenya, and many parts of Africa, is the impact of *Ralstonia solanacearum*, causative organism of Bacterial wilt of potato. A particular feature of this bacterium is its propensity to be transferred with the seed-tubers of plants that are visually healthy on field inspection. Such latent infection is particularly common with potato cultivated in cooler regions as typical of seed production. The hard-to-see field nature of *R. solanacearum* in cooler areas that are typical of seed production has thus necessitated the development of diagnostic methods of laboratory detections to support seed certification. The planting of seed tubers with even low levels of *R. solanacearum* can be expected to lead to major yield losses, especially if cultivated in warmer regions. This paper reports on the outcome of a study that compared two sampling approaches (vascular ring and heel-core) and 2 diagnostic methods (NCM ELISA and real-time PCR), and records data associated with efficacy of the process and of the level of

detection. In contrast to a more typical research study, this study centred on the need for certification bodies to provide a service that is timely, efficient and affordable i.e. in setting out what is most practicable in meeting the need of the seed producer. The approaches considered also include ideas of sharing tasks more with the private sector (seed producer and labs) as reduces the overall burden to phytosanitary bodies. The study stemmed from a workshop in October 2012, which included representation from the private sector seed producers, phytosanitary institutes, research partners and private laboratories. It was observed during that meeting of the potential unmet demand for potato seed certification if current practices were not made more efficient.

TH2ABS071

ARC potato *in vitro* genebank: the basis of the South African seed potato certification scheme

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Abstract
Potato is extremely susceptible to a variety of pests and diseases. To maintain high production levels, seed potato production has to be certified. In South Africa, the minister of agriculture has appointed the Independent Certification Council for Seed Potatoes (ICCSP) as the authority for the South African Seed Potato Certification Scheme. In turn, the ICCSP has contracted Potato Certification Service (PSC) to manage and administer the scheme. Most certified seed potato in South Africa originate from the Potato *In vitro* Genebank at the Vegetable and Ornamental Plant Institute (VOPI) of the Agricultural Research Council - Roodeplaat, The potato *in vitro* genebank houses the disease-free mother stock of three types of potato collections, namely: the open commercially produced varieties, varieties with sub-licence agreements as well as varieties maintained under contract agreements with private clients in the potato industry. *In vitro* propagated, disease-free mother stock that is multiplied by the genebank is supplied to registered South African seed producers as starting material for the production of seed potatoes. All potato accessions, prior to release to the seed producers, are tested for bacterial diseases such as *Ralstonia solanacearum*, *Pectobacterium caratovorum*, *Pectobacterium atrosepticum*, *Dikeya dadantii* and for the following important viral diseases: Potato virus X, Potato virus Y, Potato virus A, Potato virus S, Potato Leaf Roll virus, Potato virus M and Tomato Spotted Wilt virus. The role played by the ARC potato in vitro genebank remains pivotal in the production of good quality seed potatoes in South Africa, and this presentation gives a brief description of the activities performed by the *in vitro* genebank in the certification of seed potato.

Key words: Potato, in vitro genebank, Independent Seed Certification Scheme (ICCSP), Potato Certification Service (PCS)

TH2ABS099

Work of multiple organizations to improve seed potato health in USA and an example of change to reduce potato virus y in seed lots

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In the United States, seed potato improvement starts with the individual seed potato grower. The seed grower also has resources that are available from university experts and from the organizations that certify the seed potatoes. Systems that exist for the production of seed potatoes have similar, but slightly different structures in individual states. The basic principles for producing quality seed potatoes are followed in each state. Each state is signatory to a memorandum of understanding (MOU) with the national regulatory agency (USDA-APHIS). This allows trade between states and between the U.S. and other countries. The MOU requires a quality manual to be developed for each certifying state. This quality manual is a procedural manual. An audit of each certifying agency is conducted to ensure compliance with the approved quality manual. The MOU is a recent document and serves to unify practices of multiple certification agencies. This allows for a set of minimum seed standards that helps to facilitate international trade. An example of how certification practices can change to improve seed health occurred in Idaho starting in 2007. At this time, an outbreak of PVY necrotic strains occurred in commercial fields planted with infected seed. Prior to this time, 95% of the varieties were visually inspected for PVY. The other 5% of varieties were serologically tested with ELISA because of latent symptom expression. This PVY outbreak led to a change of ELISA testing of all seed lots and all varieties. Over the next 4 years the number of seed lots with PVY was reduced by 10 percentage points. The change in the seed regulations were formulated by growers and university researchers and then approved by a grower advisory committee and finally a foundation seed stocks committee which consists of the certification agency and university scientists.

TH2ABS100

Seed system lessons learned from marando bora in lakes zone, Tanzania

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Abstract
This paper and accompanying presentation will outline the key lessons learned from the Marando Bora project on getting seed systems moving through a decentralized producer & seller network back-stopped with research and extension support. The Marando Bora project was funded under the ***Sweetpotato*** Action for Security and Health in Africa (SASHA) from 2009-2011 to improve the food security of at least 150,000 families by providing farmers with quality seed of improved sweetpotato varieties in a timely fashion. This project was implemented in the Lakes Zone of Tanzania and the initiative brought together four Tanzanian NGO's (RUDDO, BRAC, TAHEA, KIMKUMAKA), two National Research partners (Agricultural Research and Development Institutes at Ukiliguru and Maruku), the

International Potato Center (CIP) as over-all project coordinator, Helen Keller International for development of educational messages and advertising, and Catholic Relief Services as field coordinator. The paper and presentation will be based on project documents and on information and insights provided by project staff and participants. Under Marando Bora, decentralized vine multipliers performed well below project expectations and partners had to employ a mass dissemination strategy in the last year of the project in order to achieve 50% of the initial project target. Outputs related to advertising and the establishments of field demonstrations were late. Subsidies to producers were not systematic. Communication and collaboration among the network of partner organizations was a challenge. Key conclusions are the importance of effective research and development partnerships, the consequence of varietal choice and validation in seed projects that have scale as an objective, the value of developing and implementing disease and seed system quality management protocols, the significance of selection criteria and managing incentives and subsidies with vine producers. This paper will review some of the most acute lessons learned applicable for practitioners: tailored and targeted subsidies can promote entrepreneurship; timely and effective advertising of new varieties and vine producers can raise effective demand and sales; simple quality control protocols can improve vine production; and documentation and traceability of planting material from research managed bulking sites promotes effective supply chain management.

Key words: entrepreneurship, quality control protocols, research & development partnerships

TH2ABS119

Insect pests affecting the seed systems of potato and sweetpotato in Ethiopia

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Abstract

Potato and sweetpotato are the major root crops grown in Ethiopia mainly for food purpose. Though these crops have high potential to fill the food shortage gap in the country, the yield per unit area of the crops are very low (may be 3-4 times lower than the world average). Among the factors limiting the production and productivity of these crops is seed impurity due to insect pests. The potato tuber moth (*Phthorimaea operculella* (Zeller)) and sweetpotato weevil (*Cylas puncticollis* (Boheman)) on potato and swetpotato are major field to storage insect pests of potato and sweetpotato, respectively. These insects damage the leaves, vines/stems and tubers of the crops often resulting in 40-86% losses. In the worst case complete crop failure is common. Tubers of potato and vines of sweetpotato are used as planting materials (seed). About 99.9% of the seed system of these crops is informal indicating that there is no standard set for seed production and distribution. According to FAO standard, these pests have 0 to 5% tolerance level. However, according to the study conducted on potato stores which are sources of planting materials, 98% of the tubers showed heavy damage (>6 feeding holes) of potato tuber moth. The remaining 2% showed slight infestation of potato tuber moth. Similar study was conducted on sweetpotato nurseries which are also sources of planting materials. The result obtained indicates that there were no sweetpotato vines without sweetpotato weevil. Under both cases not only the planting materials (seed) that are distributed throughout the country but also their pests. This

coupled with the loose internal quarantine system affected the production of potato and sweetpotato in Ethiopia. Hence, strict measure should be taken by the government to improve the seed system of these two highly important root crops.

Key words: Potato tuber moth, seed impurity, seed system, sweetpotato weevil, tolerance level, yield loss.

TH2ABS130

Minitubers: A new frontier to enhanced basic seed potato production at ADC, Kenya

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Abstract

Seed potato is seen as a vital input in any potato production system, as it's the physiological basis for vigorous crop development, genetic basis for the adaptation to varied ecological and product preferences. At the Agricultural Development Corporation (ADC) Molo Complex, a formal seed potato production system exists, however over the years, it has been unable to produce sufficient seed to farmers due to shortage of basic seed from the national potato program, lengthy field multiplications hence low yields. The seed shortage has led to farmers obtaining planting material either from the local market, neighbours or own farm saved seed. This has promoted build-up of devastating bacterial wilt and viral disease, low yields and poor quality of tubers. An improved certified basic seed potato production system capable of ensuring sustainability in seed multiplication using minitubers is now underway at ADC through collaboration with CIP. With the new var. *K. Mpya* and *K. Sherekea* the technology has worked well in getting healthy, true to type basic potato seed, rapidly, in a timely manner, under reduced field generations hence lowering costs and raising the plant health quality of the field production generation. With reduced field generations and precise set of recommended agronomic practices and inspection services by KEPHIS the seed potato produced has improved in trueness to type, quality and quantity. Potato being a promising food security crop in Kenyan households, production is expected to significantly increase, contributing to poverty alleviation through income generation, provision of employment opportunities through value addition enterprises in production, processing and marketing. Minituber production system is thus seen as a new frontier that will open a window for production of own breeder's seed at ADC, resulting in enhanced sustainability of the formal seed potato production system, to the local small scale farmer in Kenya and Africa as a whole.

Key words: *seed potato, minituber production, ADC; food security.*

TH2ABS136

Effect of tunnel screen on rate of sweetpotato vine multiplication for increased food production and income

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Abstract
Sweetpotato serves as human food, animal feed and industrial raw material in the production of sugar syrups, ethanol and flour for confectionaries. It produces more food energy per unit area and unit time than any other major food crop and has higher protein, vitamin and mineral contents compared to cassava. However, sweetpotato has a class of need and this is the survivability and availability of planting materials. It is harvested after a period of about 4-5 months and planting materials must be available for the next growing season, which can be 5-7 months later, especially in those sub-Saharan African regions with extended drought period. Most farmers are losing 4-6 weeks of the growing period at the beginning of the rainy season while they re-establish sufficient vine production for planting, obtaining initial limited planting material from residual plants, re-sprouting roots, or secondary growth of harvested fields, limiting sweetpotato production areas. Low tunnel screen covered structure was used to assess vine production rate in three (3) harvests of "Apomuden" and "Ogyefo", compared with opened raised beds, as control, in a randomised complete block design experiment with 3 replications in SARI's experimental fields. "Apomuden" recorded the highest average vine lengths of 81.6 and 59.6cm under tunnel cover and on opened beds, at 6 WAP, 65.2 and 64.6 cm the harvest at 11WAP, and 81.3 and 65.7 cm long at 16 WAP, respectively. On the contrary, the opened bed or "control" bed produced higher vine cuttings than the tunnel covered beds, with "Ogyefo" recording the highest average cuttings of 421 plantable vines and "Apomuden" recording an average of 408 plantable vines per $2m^2$ area. However, the difference in number of transplantable vine cutting yield was not statistically significant. Transplantable cuttings on opened beds for "Apomuden" and "Ogyefo" were higher compared to under tunnel cover at 6, 11 and 16 WAP, respectively; contrary to the highest vine lengths recorded under tunnel cover condition.

TH2ABS145

Transforming potato seed production in India

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Abstract
Technico are one of the world's leading Seed Potato producers using advanced technology to produce Nuclear seed certified free of disease to supply limited generation seed schemes. In 2000 Technico introduced TECHNITUBER® seed to the Indian seed potato industry to show the benefits of early generation seed, and enable the industry to meet the soaring demand from processers and consumers. TECHNITUBER® seed are small potato propagules around 1.5 grams each. They are produced in climate controlled greenhouses from tissue culture plantlets free of disease. The greenhouse crops are inspected by government officials and samples are tested and certified free of disease and virus. TECHNITUBER® seed can be produced year round using state of the art technology. Yield per plant is typically between 50 to 60 tubers, compared to traditional minituber production of between 4 to 6 tubers per plant. Technituber® seed is prepared for field planting using conditioning and storage techniques that guarantee every seed is sprouted and chitted ready for planting. The Indian seed scheme prior to 2000 was a long generation system of 30 years and was dependent only on GOVT for very limited quantity of breeder seed production. These generations were required to build up enough stocks of potatoes to go to the market. The problem with long generation seed schemes is that the impact of disease in the field, and in the storages between generations, results in diminishing yields year after year. The introduction of TECHNITUBER® seed enabled the number of field generations to be cut to 2-3. The impact of virus and disease was significantly reduced by growing only three field generations before potatoes were sent to commercial growers. The average yield of potato per hectare increased from 17 mt/Ha to 20 mt/ha within ten years. This was achieved through the supply of quality disease free seed each generation, and modern agronomy techniques. Technico is also able to source and use varieties that are suited to the Indian climate and soils through networking with breeders. This enables farmers to maximise yields and profits.

TH2ABS172

Integrated research approach for development of potato production in Chencha district, Ethiopia

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Abstract
Three integrally linked research projects yet having distinct approaches are planned to enhance the development of potato production in southern Ethiopia. The research focuses on improving the quality of seed potatoes and the potato crop in Chencha district, development actions in the context of sustainability of farming system at farm level and analysing the promotion and (non) adoption of potato technology to understand optimal research-led approach at community level. To improve the quality of seed potatoes, separately designed field experiments with associated lab tests (DAS-ELISA and quantitative PCR) for the most prevalent viruses will be employed to study the rate of seed degeneration and the effect of positive selection on regenerating degenerated seed with emphasis to better understand the mechanisms behind regeneration. Simple techniques of manipulation of physiological seed tuber age will be tested to suit seed for double cropping. FAO's concept of quality declared planting material will be adapted and innovated to create awareness that seed potatoes must meet certain standards and contribute to establishing alternative seed supply chain. To improve the sustainability of the farming system, the following steps will be followed: conduct an assessment survey, evaluate the existing farming systems in terms of efficiency of soil nutrient management, labour and economic performance, optimize the farming system using FarmDesign model, baseline assessment of GHGs emission potentials of the current farming practices using EX-ACT tool, qualitative assessment to assess resilience to climate change and conduct Potassium experiment to improve potato production and quality. To understand the optimal research-led approach for agricultural development, the study will analyse why farmers (non) adopt potato technology and its livelihood impacts. Field studies will be conducted to understand farmers' potato production practices, analyse the role of research and development networks, seed networks and farmers' socio-economic statuses on the (non) adoption of potato technology, and analyse the impacts of potato technology on farmers' food security and livelihood situation. This integrated research approach addresses the gaps of previous approaches which focus on tackling single agricultural problem at a time while different problems are interrelated.

Key words: Seed quality, degeneration, positive selection, farming system, adoption

TH2ABS229

Promising management strategy for sweetpotato weevils in Kenya

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Abstract
Sweetpotato weevils (*Cylas* Spp) are the most serious pest of sweetpotatoes not only in Kenya but world over. They cause yield loss mainly on the growing tubers, which can extend up to 100% if no action is taken under severe infestation levels. Sweetpotato (*Ipomoea batatas*) is an important food and nutrition security crop in Kenya grown mainly by small holder farmers with less production inputs. The crop provides a good source of starch for people living in semi-arid areas/harsh climatic periods. Over the years new orange fleshed varieties have been developed and promoted to provide beta carotene for consumers. The crop is now highly popular for breakfast in urban centers and its demand is increasing. However, farmers continue to face challenges in the control of sweetpotato weevil. This study tested a combination of cultural and physical control options for managing the pest. The experiment was carried out in Murang'a County in farmer fields for two years, 2011 and 2012 long rain seasons. The treatments included pitfall trap, raised trap, tephrosia planted earlier and same time with sweetpotato vines, and control. In addition, earthing up (hilling) was carried out in all the trials. The study shows that combining earthing up with tephrosia as border crop and pitfall traps can drastically reduce weevil infestation and increase yield of the crop. Farmers should be encouraged to use these methods for reducing weevil infestation and resulting losses.

TH2ABS236

Influence of organic manures, inorganic fertilizers and bio-fertilizers on yield and quality attributes of potato (*Solanum tuberosum* L.)

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Abstract
A field experiment was conducted at Post Graduate Centre, University of Horticultural Sciences, Campus, Gandhi Krishi Vignana Kendra, Bangalore during *Rabi* 2011, to study the effect of organic, inorganic and bio-fertilizers on yield and quality attributes of potato (*Solanum tuberosum* L.). The experiment was laid out in Randomized Complete Block Design with three replications involving 10 treatments *viz*, 100% recommended dose of fertiliser (125:100:125 kg NPK ha^{-1}) (T_1) ;100% RDF + 100% FYM (25 tha^{-1}) ($T_{2)}$; Soil Test Crop Response targeted yield (155:150:129kg NPK ha^{-1}) (T_3) ; 50% RDF + 100% FYM + Azotobacter (12 $kgha^{-1}$) + Phosphobacteria (12 $kgha^{-1}$) (T_4) ; 75% RDF + VC (1.5 tha^{-1}) +

Azotobacter (12 kgha^{-1})+ Phosphobacteria (12 kgha^{-1}) (T_5) ; 50% RDF + Azotobacter (12 kgha^{-1})+ Phosphobacteria (12 kgha^{-1}) (T_6) ; 50% RDF + 50% FYM + VC (1.5 tha^{-1}) + Azotobacter (12 kgha^{-1})+ Phosphobacteria (12 kgha^{-1}) (T_7) ; 100% FYM + 50% Nitrogen supplied through neem cake (62.5 kgha^{-1}) +Azotobacter (12 kgha^{-1}) (T_8) ; 100% FYM + 50% nitrogen supplied through poultry manure (1.5 tha^{-1}) + Azotobacter (12 kgha^{-1}) (T_9) and 100% FYM + 50 % FYM supplied through vermicompost (1.5 tha^{-1}) + Azotobacter (12 kgha^{-1}) (T_{10}). The plants supplied with 50% RDF + 50% FYM + AZT + PSB (T_2) recorded highest number of tuber per plant (7.87), tuber yield per plant (363.33g plant^{-1}), tuber plot yield (21.50 kg plot^{-1}) and tuber yield per hectare (34.13 tha^{-1}) which was *on par* with the treatments of T_3, T_4 and T_6, respectively. The increase in number of tubers per plant could be attributed to increased vegetative growth observed due to balanced nutrient levels, which stimulated initiation of more stolons, thus increasing the number of tubers per plant. The increased tuber yield could be attributed to better photosynthesis activity and accumulation of carbohydrates which helps in better growth of tubers. Potato tuber yield is also known to be influenced by P fertilizers through its effect on the number of tubers produced, the size of the tubers and the time at which maximum yield is obtained (T_3). Thus, based on the growth, yield, quality, cost benefit ratio and reduction in the usage of 50 per cent of chemical fertilizers it could be inferred that applications of 50% RDF + 50% FYM + AZT + PSB (T_7) was found optimum for cultivation of potato crop.

TH2ABS001

Comparison of different approaches to establish a core collection of andigena (*Solanum tuberosum* group andigena) potatoes

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Abstract
A core collection of germplasm is a representative set of accessions capturing the complete genetic diversity of the entire collection with minimum repetitiveness. In the present study, in order to develop a core set from an entire collection of 740 accessions of Andigena potato (*Solanum tuberosum* Group Andigena), data were recorded on 21 morphological descriptors during 2009-10 autumn crops at Jalandhar, Punjab, India. To select accessions for the core set, the conventional hierarchical cluster analysis and PowerCore, which apply the advanced M strategy of heuristic search, were used. In hierarchical cluster analysis three sampling strategies within clusters were followed, that is, selections made based on random numbers, selections based on maximum principal component (PCA) score, and random selections from distinct groups formed in a cluster based on Euclidean distances. Comparison of the range, mean, variance, variance difference (VD%), variable rate (VR%), coincidence rate (CR%) and Shannon-Weaver diversity index (*H'*) of the core sets made by different sampling methods showed that in the use of hierarchical cluster analysis the core set can be best sampled based on the PCA scores. However, comparison of hierarchical cluster analysis and heuristic search (PowerCore) showed that heuristic search had an edge over the hierarchical cluster analysis as the former covered more diversity, and the coverage was 100% for as many as 19 descriptors in the core set. Besides covering the maximum allelic diversity of the entire collection, the core set of 78 accessions made by PowerCore also preferentially included accessions possessing desired agronomic characters.

TH2ABS089

Comparison between fluorescent lamps and light-emitting diodes on *in vitro* growth of potato micro-plants and subsequent *in vivo* performance and mini-tuber production

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Abstract
Morphogenesis, growth and tuberization of potato in *in vitro* conditions can be influenced by light quality. Plant tissue culture normally uses fluorescent lamps (FL) to provide the red (R) portion of the light spectrum and lots of green light, which is usually reflected from leaves leading to low efficiency per quantum of light within PAR range. New light sources such as light-emitting diode (LED) lamps would provide more PAR for in-vitro plant growth in addition to being energy efficient with low heat emission. Consequently, experiments were conducted to study the effect of LED's and FL on *in vitro* growth and subsequent mini-tuber production in tissue cultured potato plantlets of three European potato varieties, Kardal, Melody and Timo. The LED's were tested at a low, 76µ mol $m^{-2}s^{-1}$and high, 120µ mol $m^{-2}s^{-1}$, light intensity and compared with FL at 120µ mol $m^{-2}s^{-1}$ as control. For each variety, three plantlets representing one repetition in each light source were used. Results show that rate of plantlet growth, the number of nodes, internode length and average plant height after four weeks in *in vitro* growth were significantly (P≤ 0.05) affected by potato variety and light source but not their interaction. However, potato plantlets grown in LED's conditions had more nodes than plantlets grown under FL. Shoot biomass was significantly (P≤ 0.05) influenced by potato variety but not light source while root weight was significantly (P≤ 0.05) influenced by both potato variety and light source. Plantlets grown under low LEDs intensity had a significantly lower root weight than plantlets grown under high LEDs intensity. There were no significant difference in both root and shoot weight for plants grown under both FL and LEDs at 120µ mol $m^{-2}s^{-1}$. Light source during micro-propagation did not significantly (P≤ 0.05) affect mini-tuber production in *in vivo* conditions except potato variety where Timo produced significantly (P≤ 0.05) more tubers per plant than Kardal and Melody. LED lamps at 120µ mol $m^{-2}s^{-1}$ offered similar growth in plant tissue culture as FL and have advantages of high energy efficiency and longer durability than FL. Therefore, future plant tissue culture consider LEDs as a better alternative to FL for provision of light energy in controlled plant growth environments as a means of saving energy without compromising plantlet performance.

Keywords: *PAR, micro-propagation, in-vitro light quality, residual light effects*

Theme Three

Major advances in breeding and crop management

TH3ABS031

Achievements in evaluation and release of late blight tolerant potato varieties in Kenya

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Abstract
Potato late blight caused by *Phytophthora infestans* is a major cause of low crop yields in major potato growing areas in Kenya. Utilization of host resistances to the pathogen has been most preferred method used to sustainably manage this devastating disease. This review outlines the efforts that have so far been made in evaluation and release of improved late blight tolerant varieties in response to the needs of the local farmers and consumers. Late blight tolerance is one of the major traits used in selecting new improved varieties in the national potato breeding programme. It is also a major variety adoption criterion among the small scale farmers. Breeders have therefore been developing and selecting newer varieties to replace the older less resistant varieties with more resistant ones. Different breeding strategies from different potato breeding programs around the world have led to release of several varieties in the country with diverse characters. The most recent breeding strategy has achieved higher levels of late blight resistance through breeding for horizontal resistance which has facilitated efficient selection and release of superior varieties with durable resistance. Utilization of such improved varieties has significantly reduced fungicide sprays, improved crop yield and profitability of potato farming. Future parents for cross breeding local varieties can be sourced from such improved clones and can generate genotypes with multiple important market demanded characters such as short dormancy, good storability, good chipping and crisping quality which attracts higher consumer acceptability.

Keywords: potato, late blight, resistance, varieties, Kenya.

TH3ABS219

Adaptation trial of orange-fleshed sweetpotato cultivars in rain forest and Guinea Savannah agro-ecology of Nigeria

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Abstract
The study between 2010 and 2011 investigated the adaptation of introduced sweetpotato cultivars (CIP 440293, Centennial, Ex-Oyunga, and CIP199004-2) and landraces (Ex-Igbariam, Danzaria and Katsina) of orange to yellow-fleshed sweetpotato to different agro-ecology in Nigeria. Stable and high yield with good quality are important factors that contribute to the acceptability of new cultivars in Nigeria. There were seven treatments which consisted of four Orange-fleshed (CIP440293, CIP199004-2, Centennial and Ex-Oyunga) and three yellow-Fleshed (Ex-Igbariam, Danzaria and Katsina) sweetpotato cultivars. The experiment was laid out in a randomized complete block design with three replications. In most cases, percentage (%) establishment at 2 and 4 weeks after planting (WAP) of all the cultivars were high (>90%) in Nyanya and Vom (Guinee savannah) than in Umudike (<72%) locations (Rainforest) in both seasons. High virus incidence was recorded in Umudike than obtained in Nyanya and Vom. On the average, sweetpotato graded yields obtained from CIP440293 were higher than those from other cultivars in order of CIP440293>Ex-Igbariam>Katsina>Danzaria>Ex-Oyunga>Centennial>CIP199004.2. Though the dry matter of CIP440293 was low (20.3%), the quality in terms of β-carotene was superior (13.39mg/100gfw or 1032.5 RE/100gfw) to other cultivars and the least obtained from Ex-Igbariam and Katsina (0.12mg/100gfw or 10.0RE/100gfw).

Key words: Adaptation, Guinea Savannah, Nigeria, Orange-fleshed sweetpotato, Rainforest agro-ecology.

TH3ABS105

An analysis of genetic gains for sweetpotato root yield, varieties released and adoption in Malawi

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Abstract
Sweetpotato is one of the important food security crops in Malawi where vitamin A deficiency remains a key problem especially in children. Genotypic screening for improved yields and beta-carotene therefore provides the basis for a sustainable approach to food security and vitamin A deficiency reduction especially among the nutritionally vulnerable groups. Other traits of equal importance include resistance/tolerance to major pests and diseases, dry matter and organoleptic acceptability and of late, value addition characteristics such as crisp making. The first improved sweetpotato variety, Kenya (SPN/O) was released in 1988 in the country with an average yield of 20t/ha as opposed to the Kamchiputu and Yoyera, the then recommended local varieties which yielded 3 to 7t/ha each. Over the years, sweetpotato breeding has been active in the country where different populations including introductions have been screened, superior genotypes advanced and evaluated in multi-location trials. To date, 14 improved varieties have since been released that have partly contributed to increased on-farm yields from 5.23t/ha in 1995 to 17.02t/ha in 2008/09. However, genetic

gains on sweetpotato yields among the released varieties has not gone beyond 35t/ha attributed to acceptability taste which farmers consider highly in variety selection. For instance, Kakoma (35t/ha), a variety released in 1994 which was massively disseminated to farmers along with Kenya in 1995 season is hardly grown by farmers. However, Chipika (30t/ha), a recently released variety (2011) is on high demand by farmers indicative of high preference and therefore adoption. Orange fleshed varieties, namely Zondeni (2008) and Kadyaubwerere (2011) which are specifically being promoted to contribute to vitamin A deficiency reduction reveals high adoption. In general, for as long as farmers base on Kenya, Kamchiputu and Yoyera for taste acceptability, doubling yields in the current situation of diminishing land holding sizes, increased food demand due to increased population growth and urbanisation remains a challenge. Investing to change peoples' mind set for commercialisation and value addition therefore is of prime importance.

Key words: genetic improvement, preliminary yield trial results

TH3ABS190

Analysis of genetic diversity in selected potato varieties at Kuru, Nigeria

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Abstract
Twenty potato genotypes collected from different locations were evaluated in 2006 and 2007 cropping seasons to study genetic diversity using Mahalanobis's D^2 – technique for tuber yield and its components VIZ: average tuber weight of plant (ATWP), number of leaves per plant (NLPP), plant height (PH), number of tubers/plant (NTPP), tuber weight per plant (TNPP) and number of stems per plant (NSP). The 20 potato genotypes were grouped into five clusters of which cluster I was the largest with six genotypes followed by clusters II and III with four each. Cluster IV and V contained three genotypes each. The highest inter-cluster distance was between clusters I and cluster V followed by cluster I and cluster II showing wide diversity among the groups. The highest inter-cluster distance was observed in cluster V and lowest in cluster I. the Inter-cluster distance in most of the cases was higher than the intra-cluster distance indicating wider genetic diversity among the genotypes of different groups. Based on mean performance of genotypes, genetic distance and clustering pattern, it was concluded that hybridization involving genotypes from cluster II, III and V may have produced highly heterotic hybrids.

Key words: Potato genotypes, Mahalanobis's D^2 technique, Inter-cluster, Genetic diversity.

TH3ABS011

Assessing effectiveness of arbuscular mycorrhizal fungi inoculants on perfomamnce of orange fleshed sweetpotato

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Abstract
Arbuscular mycorrhizal fungi (AMF) play a significant role in improving uptake of nutrients, especially phosphorus and protect plants from soil borne diseases. A greenhouse study was conducted to assess efficiency of four AMF commercial inoculants on productivity of two orange fleshed sweetpotato varieties namely Kabode and SPK004 in phosphorus deficient soils of Western Kenya. Single species of *Glomus aggregatum, Glomus mosseae*, *Glomus etunicatum* and *Glomus intraradices* were evaluated singly or in mixture. The different AMF cultures enhanced the vine and root biomass and soil available phosphorus. *Glomus mosseae* was the most efficient inoculant with 12.29t/ha vine yield and 9.34t/ha root yield while *Glomus etunicatum* performed poorly with 8.95t/ha vine yield and 6.25t/ha root yield. Soil available phosphorus was enhanced in *Glomus mosseae* inoculated plants giving

11.21mg/kg. In terms of root colonisation, *Glomus intraradices* and *Glomus etunicatum* were effective on both Kabode and SPK004 varieties with 19.89% and 28.89% root infection frequencies of respectively. AMF microbial inoculants are a promising component of enhancing production of nutritionally important orange fleshed sweetpotatoes in an environmentally efficient way.

Keywords: Arbuscular mycorrhizal fungi, orange fleshed sweetpotato, *Glomus species*, colonization.

TH3ABS012

Breeding advances in TPS hybrids under long day conditions

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Abstract
Potato (*Solanum tuberosum*) is 3rd most important world food crop after wheat and rice. Compared to cereals potato has higher productivity in unit time and land but inefficient seed system for low multiplication rate (1:10) and huge volume of tubers (10% of total produce) needed each time to grow potatoes. Furthermore, high cost and paucity of quality tuber seed have been major constraints to potato production in many countries. True potato seed (TPS) technology, developed at the International Potato Center (CIP), has shown great prospects for producing potatoes in many countries. Except segregation for plant and tuber characters, TPS has many benefits over tuber seed. Most TPS hybrids released/recommended for potato production in different countries are adapted to short days. The major objective of present research was to select TPS hybrids adapted to long days and exhibiting least segregation for tuber characters. The research was conducted at Tuberosum Technologies Inc. a Canadian company in Broderick, Saskatchewan involved in testing novel technologies for enhancing yield and tuber quality. About 100 commercial potato varieties available in Canada were screened for flowering and pollen fertility. Couple hundred bi-parental crosses were attempted among varieties having attributes suitable for TPS production. Hybridization was done among high yielding genotypes selected from different crosses. 300 bi-parental crosses and 50 open-pollinated TPS families were evaluated for yield and tuber characters at 75-80 days after transplanting TPS seedlings. Harvests of all plants within TPS progenies were examined for variation in tuber number/plant, shape, size and skin/flesh color. TPS families with high yield and minimal segregation were identified. Hybrids TT-11-017 and TT-11-018 produced average 30 tubers/plant (red skin and white flesh in all plants). Other promising TPS hybrids viz., TT-10-024, TT-11-044, TT-11-075, TT-11-081, TT-11-088, TT-11-089, TT-11-094, TT-11-217 and TT-11-228 produced tubers fairly uniform for skin and flesh color (white to light yellow) and number ranged between 20-39 tubers/plant. Tubers in each of the above TPS hybrids revealed no difference in cooking time, texture and taste. Promising TPS hybrids could help potato industry wherever quality tuber seed is not easily available.

Keywords: TPS, hybrids, breeding, segregation, parental lines.

TH3ABS021

Breeding for high beta-carotene, dry matter content and yields in sweetpotato in Burkina Faso

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Abstract
The potential of sweetpotato to address food security, malnutrition and poverty is acknowledged in Sub-Saharan Africa. The present study was undertaken to develop varieties combining yield and quality in order to address food security and malnutrition in Burkina Faso. Eight parents (five farmers' preferred cultivars with various flesh colour and three introduced orange-fleshed sweetpotato varieties) were selected to develop populations and, subsequently, to estimate heritability and genetic gain from breeding. One hundred thirty F_1 and their eight parental clones were evaluated in three locations in an Alpha Lattice design to identify high yielding and beta-carotene rich clones with specific or wide adaptation attributes to the local environments. Parent-offspring regression analyses and estimated genetic gain suggested rapid progress in dry matter content with high heritability (0.76±0.03) and high genetic gain (22.60%) and in beta-carotene content also indicating high heritability (0.90±0.04). Low heritability (0.21±0.16) associated with low genetic gain indicated that increased storage root yield would be slow. Despite the substantial improvement achieved for yield and beta-carotene, further evaluations will enable better varietal recommendation to farmers.

TH3ABS064

Breeding Orange-fleshed sweetpotato: Developments in the South African Program

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Abstract
Orange-fleshed sweetpotato is promoted in South Africa to address both food security and vitamin A deficiency which is a major public health problem. It is estimated that about 14.3 million people are vulnerable to food security, while 64% of 1-9 year olds and 27% of women at childbearing age in the country are vitamin A deficient. However, only varieties with desired traits will be adopted by farmers and consumers. The focus of the breeding programme at the ARC-VOPI is on high beta-carotene content combined with good yield, good storage quality, and high dry matter content and sweet taste. Both polycrosses and directed crosses are employed to create new lines with over 5000 seedlings obtained annually. After screening of these new lines to select for orange fleshed progenies, they

proceed to a field trial. Positive selection is employed for root quality traits and dark orange flesh color, number of roots. Only about 2% are selected for further evaluation. The selected lines are first evaluated in non-replicated plots for two years (initial evaluation and preliminary evaluation) at the main station only, and promising lines are thereafter evaluated in replicated trials at three sites in the intermediate and advanced yield trials. In this case positive selection is employed for high yield, dark orange flesh, sweet taste, high dry matter and good storage root quality. The promising lines are also screened for tolerance to drought, stem blight and virus. Superior lines are exhibited to companies for commercialization, while resource-poor farmers are exposed to improved varieties through farmers' days and demonstration trials. Cultivar Bophelo was made available royalty-free for distribution to resource-poor farmers and community projects. During 2011/12, 70 000 cuttings of this cultivar were issued for production. On the other hand, an exclusive license for commercialization of cultivar Purple Sunset was granted to a large commercial farmer. Another five lines have been issued to commercial entities based on Material Transfer Agreements to allow evaluation for potential commercialization in the niche markets of export and processing.

Keywords: high dry matter, licensing, total carotenoid, yield

TH3ABS155

Cloneselector: A new tool for accelerated analysis of sweetpotato and potato breeding trials

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Abstract
Breeding programs involve large investments of time and money, but can pay very large returns on investment in the form of improved varieties which benefit farmers, societies and the environment. International breeding efforts involving multiple partners and targeting regionally important constraints have great potential for efficiently and rapidly achieving impact. Standardized information on the performance of progenies and selected clones across environments is necessary in order to assist breeders to efficiently make decisions about selection and variety release. Standardized methods also facilitate sharing and reporting of breeding program results with colleagues and the agencies that support us. Clone Selector is a tool developed to help plant breeders, especially with clonally propagated crops, carry out field trials, analyze results and make selection decisions. In version 3.0 its functionality may help you to elaborate the list of germplasm to test, to create the statistical design and the corresponding field book, to register experimental data as well as information about the experiment, to calculate derived variables and to produce some statistical results. Clone Selector is an Excel based tool that, through a set of Visual Basic macros offers a friendly user interface, and by using the add-on Excel for Microsoft Excel connects with R (R Core Team, 2012) to use its statistical computing and graphic capabilities. Up to now Clone Selector generates field books for three statistical designs: the randomized complete block design, the augmented block design and the alpha lattice design; in addition it can create field books with no randomization and no replication which are important in the first stages of breeding - the so called observational trials. Clone Selector computes standard ANOVA results for single location trials for all the three different

statistical designs. For multi environment trials Clone Selector offers traditional ANOVA results, variance components and heritability estimations based on REML and stability analysis results from three different approaches: the linear regression approach, the Additive Main effect Multiplicative Interaction analysis, and the Tai's stability analysis. Being open source, Clone Selector provides a license free alternative to breeding data analysis and a powerful data management tool using the widely used Excel spreadsheet.

TH3ABS148

Changing population of *Phytophthora infestans* in Kenya and perspectives for blight control

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Abstract
Potato blight caused by *Phytophthora infestans* remains the leading biotic constraint to production of potato (*Solanum tuberosum*) which is the second most important food crop in Kenya. Until recently, the local population of *P. infestans* in Kenyan was a typical US-1 clonal lineage of A1 mating type associated with the worldwide dispersal of this potato blight pathogen in the 1970s. Up to this point, blight management strategies were based on key phenotypic characteristics of the US-1 clonal lineage, namely fungicide sensitivity and virulence to potato host. For example, although large-scale resistance to phenylamide fungicides (e. g. metalaxyl) has been widely reported globally, field resistance to metalaxyl is yet to be reported in Kenya. Intriguing results from a study employing molecular markers on isolates of *P. infestans* obtained from Kenya have indicated occurrence of new genotypes in high frequencies. Whether the recently occurring genotypes will upset blight control strategies already in place is currently unknown. Based on what is known about these newly occurring genotypes of *P. infestans,* this paper puts into perspective the implications of these changes to blight control. Apart from exploring the possible factors responsible for the changes in the local *P. infestans* population, the paper also relates these changes to available data on trends in *P. infestans* populations in other places. Efforts to mitigate the impact posed by these changes are likely to be hampered by growing cross-border trade in potatoes as well shifts in weather patterns which have resulted in wetter growing seasons in some years. A program comprising of regular monitoring of the composition of local *P. infestans* population; regular screening of local isolates for sensitivity to fungicides and their pathogenicity on existing potato germplasm is needed to ensure that strategies to combat potato blight evolve in tandem with emerging pathogen population patterns.

Key words: *Phytophthora infestans,* population changes, *Solanum tuberosum,* metalaxyl resistance

TH3ABS225

Determining the mode of inheritance to late blight resistance in potato progenies

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Abstract
Potato is an important source of most farm family food and income in the highlands of East and Central Africa. Development of superior varieties with improved agronomic characteristics will enhance potato productivity and marketability. However, late blight (*Phytophthora infestans*) accounts for the greatest constraint to potato production and yield loss in particularly tropical highlands including Rwanda and Uganda. Consequently a study was conducted to determine the mechanisms of inheritance to late blight resistance among new progenies and select promising ones for further screening. To achieve this objective a set of F_1 potato progenies was evaluated. This set contained F_1 potato progenies obtained from single crosses with Uganda 11, a local and resistant variety grown in Uganda and putative of major genes. The F_1 progenies were evaluated in the field for late blight severity under natural conditions in addition to artificial inoculation with a local late blight isolate. The segregation ratios observed suggests the occurrence of major (R) genes controlling late blight resistance. Resistance to late blight severity displayed epistatic effects, partial dominance and additive effects in the evaluated crosses. The obtained results indicated that the existence of dominant R- genes action was evident. From this set, 190 F_1 promising progenies were selected for further field screening.

Key words: Potato, late blight resistance, epistatic effects, dominance effects, additive effects.

TH3ABS047

Development and evaluation of new sweetpotato varieties through farmer participatory breeding for high altitudes in Kenya

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Abstract
Sweetpotato (*Ipomoea batatas* L) plays a significant role in promoting food and nutritional security in Kenya. However, increased production is limited by constraints including sweetpotato virus diseases (SPVD) and weevils (*Cylas* spp); low yielding landraces (9-12 tons/ha compared to potential average of 30 tons/ha); shortage of clean planting materials; lack of appropriate post harvest handling technologies; and poor market access. Currently there are no suitable varieties for high altitudes. Therefore the sweetpotato breeding

programme at KARI-Njoro objective was to develop high yielding varieties for high altitudes with resistance to SPVD and weevils, improved food quality, early maturing and wide adaptability, which meets consumer preference and market needs. All trials were carried out in Central Rift Valley. A germplasm collection of 400 landraces, improved and imported accessions was established and used as a basis of the breeding programme. The activities included collection, characterisation and selection of 36 parents for breeding; hand and polycrossing of the selected parents; critical selection from the established 2200 seedling nursery; selection of 43 superior entries from preliminary yield trials; and 10 entries from national performance trials (NPT). A multi-location National Performance Trial (NPT) of randomized complete block design with three replicates was established in five sites; Kabianga (LH1-1745 masl); ATC Koibatek (LH3- 2167 masl); KARI-Lanet (LH4-1920 masl); Mtakatifu Clara Lare (LH4-1900); and KARI-Njoro (LH3-2166 masl) for the 10 entries. Participatory variety evaluation involving researchers, extensionist, plant regulators and farmers was adopted in all the trials. Standard operating procedures and analyses were used to evaluate yields; viruses and weevils; dry matter content; beta carotene and acceptability by consumers. The main result of the trials' evaluation was the release of five new varieties – two orange fleshed (KNSP 06/1 [2] and KNSP 02/16 [1]); one light orange fleshed (KNSP 010/6 [1]); one yellow fleshed (KNSP 013) and one white fleshed (KNSP 016). The improved varieties have better storage root yields (average 20 t/ ha) compared with the average national storage root yields; moderate levels of field resistance to sweetpotato virus disease (SPVD); weevils; moderate dry matter content (26-32); and consumer acceptability. The OFSP varieties will provide consumers with moderate provitamin A contents which will alleviate vitamin A deficiency in Kenya. Through participatory breeding, production capacity of sweetpotato at high altitudes has increased providing food security; farmer adoption knowledge has improved; market strategies have been determined; and food quality has improved. Variety recommendation is agro-ecological specific.

Key words: *Ipomoea batatas,* breeding, participatory variety evaluation, Provitamin A

TH3ABS083

Development of dual-purpose sweetpotato varieties through participatory breeding in Rwanda

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Abstract
Sweetpotato forms a major part of diet of both rural and urban communities in Rwanda. Moreover, it is expected that the crop could even become more important than it is already now, especially for farmers operating in mixed crop-livestock systems by using vines as animal feed. Its usefulness in terms of both food and feed makes it attractive in areas where land availability is a constraint. The interest in sweetpotato as animal feed is associated with the implementation of policy regarding zero grazing practices as one of the ways to reduce soil erosion. This research was conducted to develop dual-purpose sweetpotato varieties through participatory breeding, using accelerated breeding scheme. Sixty parents comprising local cultivars and introduced germplasm were used in a crossing block, in a factorial controlled cross design. Four thousand (4,000) polycross true seeds and 4,000 controlled cross seeds were generated. In total, 5380 well-established genotypes were

selected from the seedling nursery to be planted in an observational trial at Rubona, Karama and Ngoma, in a randomized complete block design, with two replications, during 2011B season. Participatory selection was conducted in various selection stages and best clones were advanced in later breeding stages. Data were collected on root and vine yield related traits such as marketable root weight (MRW), marketable root number (MRN), vine weight and vine vigor. To assess dry matter of roots and vines, 200g from each of the top 10 performing clones was oven-dried at 65^0C up to constant weight. Selection of dual-purpose clones was based on the range of the ratio of roots to vines in terms of dry matter yields, where a clone with a range 1.5-2.0 was classified as a dual purpose clone. Data were analyzed using GenStat program. Ten best performing dual-purpose clones, namely RW 11-2560, RW11-3736, RW11-2910, RW11-1860, RW11-2285, RW11-17, RW11-5091, RW11-4923, RW11-2419 and RW11-3074 were planted in a national performance trial. Referring to the tasting test, two best white-fleshed genotypes selected in terms of farmer ranking were RW11-RW11-1860, RW11-17, whereas the clone RW11-2910 was ranked first among the orange-fleshed varieties. Six clones out of 10 performing clones were recommended for release.

***Key words*:** Clone, dry matter, roots, vines, yield.

TH3ABS084

Development of potato varieties resistant to late blight

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Abstract
Potato production in sub-Saharan Africa (SSA) has more than doubled since 1994, with 70% of that growth concentrated in Eastern Africa. Despite these gains, potato yields of small-scale farmers in the region fall far short of their potential due to various factors including biotic and abiotic constraints, inadequate supplies of high-quality seed and smallholders' limited awareness of better seed management practices. The most devastating disease is late blight (LB) caused by *Phytophthora infestans* (Pi) and is still responsible for significant losses which may reach 30% to 75% depending on the varieties in SSA. One of our current strategies to control this devastating disease include stacking broad-spectrum resistance genes isolated from wild potato relatives through transgenesis. The *RB*, *Rpi-blb2* (isolated from *Solanum bulbocastanum*) and the *Rpi-vnt1.1* (isolated from *S. venturii*) *R* genes can be transferred by genetic engineering into susceptible farmer-preferred varieties. These *R* genes were cloned into a triple *R* gene construct (pCIP99) to transform two susceptible potato varieties grown in SSA. 'Desiree' was chosen essentially because of its high transformation efficiency and for testing efficacy with single and the stacked *R* genes whereas 'Victoria/Asante' for its wide adoption as stable variety in Kenya and Uganda. The later will only be transformed with the 3*R* gene stack. Out of 62 transgenic events produced with *RB* from 'Desiree', we identified 7 that display high levels of resistance to *Pi* based on a whole-plant infection assay in the biosafety greenhouse followed by assessment of disease progression at ABL in Peru. Resistance was confirmed and related to number of copies of

the *RB* gene (2 to 4). These transgenic events have been transferred to BecA in Kenya. Other transgenic events from 'Desiree' (62, 115, 327 for *Rpi-vnt1.1*, *Rpi-blb2* and the 3*R* genes, respectively) and 14 from 'Victoria/Asante' with the 3*R* genes are being screened for gene expression and LB resistance. The durability of the resistance mediated by the 3*R* gene stack will be predicted based on data from existing pathogen diversity, frequency of isolates compatible with the individual *R* genes, and pathogen population dynamics during confined field trials. This research is anticipated to be conducted with NARS partners, NARO-Uganda and KARI-Kenya.

TH3ABA010

Diallel analysis of sweetpotato [*Ipomoea batatus (*L.) Lam] genotypes for combined beta carotene and dry matter content in southern guinea savanna, Nigeria

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Abstract
Roots of orange fleshed sweetpotato (OFSP) varieties currently available in Nigeria contain high quantities of β-carotene or pro-vitamin A but have high moisture content. These varieties have been found to be a cheap and crucially important remedy for vitamin A deficiency. The cream or white fleshed varieties on the other hand, have a sweet taste but high dry matter content, giving a dry texture, a quality trait preferred by the communities in Kwara State, Southern Guinea Savanna, and Nigeria. Development of sweetpotato genotypes that can combine these two important quality traits is the objective of this breeding work. A diallel experiment using six parental sweetpotato genotypes crossed in all possible combinations were carried out and Thirty progenies were evaluated for beta carotene (β-carotene) and dry matter content in Landmark University, Omu Aran, Kwara State, Nigeria (Southern Guinea savanna). The selected 30 F1 progenies along with their parental lines were planted in the same field trial. The trial was laid out in 6 x 6 triple Lattice in two replications. Highly significant (P≤ 0.01) differences were observed among the genotypes for the traits. The average β-carotene content among the progenies was 2.86 (mg/100g.f.w) while the dry matter content had a mean value of 31.89%. The cross progenies 199024.2 x Excel which had the highest beta carotene (14.37mg/100g.f.w) content with highest dry matter content (40. 10%) are therefore recommended for further evaluation.

Key words: Diallel analysis, β-carotene, dry matter, sweetpotato

TH3ABS201

Durable cisgenic resistance to *Phytophthora infestans* in potato and perspectives for applications in Africa

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Abstract
A promising strategy to combat late blight in potato is to combine different resistance genes to build a durable resistance. Resistance genes from wild relatives can be introduced by breeding or by transformation. Single resistance genes are not durable because mutant pathogens that avoid recognition will easily be selected. Genetic engineering is a straightforward method to introduce a combination of natural resistance genes into a potato cultivar. Since these genes can also be introduced by breeding, the resulting potato plants are called cisgenic, in contrast to transgenic potatoes that have received DNA from non-crossable species. Three R genes (*Rpi*), *Rpi-sto1* (*Solanum stoloniferum*), *Rpi-vnt1.1* (*S. venturii*) and *Rpi-blb3* (*S. bulbocastanum*) were cloned and transformed separately or as a combination into the susceptible cultivar Désirée. The transformed lines were screened for late blight resistance using a detached leaf assay, and they were also evaluated for true to type performance in the greenhouse. Selected lines were tested in field trials in The Netherlands and Belgium in 2011 and 2012 in comparison with the susceptible parent Désirée, and other susceptible and resistant cultivars. In both years the plots were not treated with fungicides against *Phytophthora infestans*. In contrast to the summer of 2011, the summer of 2012 was very humid resulting in a high natural disease pressure. Nevertheless the two seasons showed similar results with clear differences between the susceptible reference lines and the genetically modified resistant lines. About twenty resistance genes against *P. infestans* have currently been mapped or cloned and more will follow. Therefore a collection can be generated of double or triple resistant cultivars that have the potential to make potato cultivation much more sustainable. Based on the current potato cultivation area in East Africa and on different estimates of possible acceptance of this new technology, the effect of using cultivars with durable resistance on increasing potato yield in East Africa can be predicted.

TH3ABS116

Effect of *Crotalaria grahamiana* green manure on the growth and yield components of potato in the Western Highlands of Cameroon

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Abstract
Organic fertilizers are indispensable for potato production in the densely populated western highlands of Cameroon. Farmers in this area often use expensive chicken manure for potato production. The main objective of this work was to evaluate the potential of *Crotalaria grahamiana* as a less expensive source of organic fertilizer in potato cultivation. The treatments tested consisted of crotalaria green manure obtained from: crotalaria plants previously intercropped or relay intercropped with potato, crotalaria plants grown sole; chicken manure; mineral fertilizer; combinations of crotalaria green manure and mineral fertilizer; combination of chicken manure and mineral fertilizer and a control arranged in a randomize complete block design with four replications. Analysis of variance, mean separation, contrast analysis, correlation and regression analysis were carried out on the untransformed raw data. Experimental units treated with a combination of chicken manure and mineral fertilizers had significantly higher ($P<0.05$) average crop cover fraction. There was no significant difference ($P<0.05$) amongst plots treated with chicken manure, combination of crotalaria green manure and mineral fertilizer, crotalaria green manure obtained from the intercropping system and crotalaria obtained from the sole cropping system. The smallest value was obtained from the control. The highest average total fresh tuber weight per plant was obtained from plots treated with a combination of chicken manure and mineral fertilizers and those treated only with chicken manure, followed by treatments with a combination of crotalaria and mineral fertilizer and crotalaria green manure sole. Statistically significant ($P<0.001$) quadratic relationships were obtained between crop cover fraction and total fresh tuber weight per plant; crop cover fraction and number of tubers per plant. In treatments where crotalaria was combined with mineral fertilizer, it was observed that for the given amount of mineral fertilizer applied, the quantity of crotalaria green manure applied to the soil was related to the weight of tubers per plant in a cubic fashion and similarly for seed number. Results obtained so far show that crotalaria green manure can contribute as a bio-fertilizer in potato production when the quantity of leafy biomass applied as green manure is optimal.

Key words: crotalaria, crop cover, potato growth and yield.

TH3ABS002

Effect of staking on flower induction, pollination and cross-compatibility among sweetpotato

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Abstract
Glass houses have been used to induce flowering in sweetpotatoes for purposes of breeding. However, these structures are expensive to construct and/or maintain. Thus this study investigated effects of staking the sweetpotatoes in the field as a way of flower induction for purposes of pollination and testing cross-compatibility in sweetpotato. Two field experiments (staking and non-staking) were carried out at Ibadan from 24th July 2010 and 30th April 2011 using Randomized Complete Block Design with three replicates. In the first experiment (non-staked), vine cuttings of 40 parent clones were evaluated for flowering while staking was done for the second experiment, which was also used as a crossing block. Vine cuttings of the 40 parent clones were planted on heaps at 1 x 1 m with two 25cm cuttings per heap, staked with 2 m wooden poles. The main vines were tied and trained up the stakes to induce flowering. Clones that flowered were crossed in a diallel. Dried fruits were harvested at 50 days after pollination. Seeds from these fruits were soaked in water and planted in polythene bags to test their viability. Results from these studies showed that there was no flowering in non-staked sweetpotatoes whereas 18 out 40 clones produced flowers when staked. Blesbok and 440168 clones had longer anthers than their stigma while it was opposite in the others. Some clones had anther and stigma at the same height. Of the 324 cross-combinations conducted on the 18 clones, that flowered, only 109 produced seeds. The mean percentage cross-compatibility for the 18 clones was 44.3%. Compatibility varied considerably among the clones between 5.4 and 68.7 %, with clone W-151 showing the highest level (68.7 %). All flowering clones were observed to be self incompatible. The hybrid seeds obtained from the flowering clones had a mean seed emergence of 50.6 %. From this study, it is concluded that stakes induced flowering in 18 parent stocks and therefore can be used to facilitate hybridization in sweetpotato for improved hybrid seed production. However, further work could be done to enhance success in flowering of clones.

Key words: staking, compatibility, fertility, sweetpotato

TH3ABS033

Evaluating arbuscular mycorrhizal fungi (amf) and phosphate solubilizing bacteria (psbs) inoculants on performance of potato (*Solanum tuberosum)*

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Abstract
Production of potato in Kenya constitutes 0.3% of the world's total and 6.5% of Africa's production. The major production constraint is rapid decline in soil fertility occasioned by continuous cultivation without adequate replenishment of mined nutrients. Most potato growing areas have acidic pH of less than 5.5 which further limits availability of essential nutrients. An alternate plant strategy for coping with deficiency is the establishment of a mycorrhizal symbiosis with an appropriate bacterium as biofertilizers to enhance productivity of the crop nutrition and reduce fertilizers and pesticides inputs. This study, therefore evaluated the effect of Arbuscular Mycorrhizal Fungi and Phosphate Solubilizing Bacteria inoculants on performance of three Kenyan potato genotypes. Potato plantlets were planted in completely randomized block design with nine treatments of seven different combinations of AMF and PSB, and two controls including fertilizer treatment with no inoculant and one lacking both inoculants and fertilizers. The parameters evaluated were total minituber weight, shoot weight and root mycorrhizal colonization. The results indicated that total minituber weight varied significantly (P≤0.05) among varieties and treatments. The highest tuber number of 7tubers per pot and shoot phosphorus of 0.14% was recorded in Tigoni inoculated with *Pseudomonas* and *Glomus intradices* while the lowest was in Kenya Mpya with 5 tubers per pot and 0.08% P under control with no fertilizer and microbial inoculants added. Different varieties and treatments significantly (P≤0.05) influenced the fresh weight of potato shoots with the highest shoot weight 52.8g per pot recorded with Tigoni variety inoculated with a combination of *Pseudomonas* and *G. intradices* while Asante with no microbial inoculant and fertilizer treatment recorded the lowest shoot fresh weight of 10.8g. The highest shoot dry weight of 4.9g per pot was recorded with Tigoni variety inoculated with *Glomus intradices* and *Pseudomonas.* There were no significant (P>0.05) differences among the varieties and treatments in the percentage mycorrhizal root colonization. As sustainable and environmental friendly method of increasing crop production, there is need to create awareness on the importance of these microorganisms in agriculture.

Key words: potato, *Glomus intradices*, *Pseudomonas spps*, root colonization

TH3ABS162

Evaluation and release of B3 potato (*Solánum Tuberosum* L.) varieties in the Angolan highlands

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Abstract
Commercial potato varieties have been introduced into Angola in a non-systematic manner without fully taking into account the natural conditions, and without regulated production of seed potato within the country. This has partly led to its low productivity with an average of 7,86 t per ha reported in 2012. In 2010, twenty CIP-B3 potato clones with improved late blight resistance (*Phytophthora infestans*) were introduced into Angola and testedin two agro-ecological highland regions: Huamboprovince (Ecunha, Chipeio and Chilela) and Huila province (Humpata and Chibia). The selection was carried out with a participative evaluation component with farmers and consumers establishing their preferences in regard to the market quality aspects and taste. From this, five clones were selected to be released in 2012. The selected B3 clones with the CIP codes 371056.175, 395015.6, 39511.13, 393382.44, 396036.201, had yields of 15-25 t per ha with application of Positive Selection, and showed significantly improved late blight resistance compared to the commercial varieties used as standards (cv. Romana, cv. Diamante). The released varieties have potential of reducing cost of production to farmers through minimal use of fungicides.

TH3ABS163

Evaluation and release of orange-fleshed sweetpotato (*Ipomea batatas* L.) varieties in the Angolan highlands

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Abstract
Sweetpotato is a basic food crop and source of family income in Angola. The white and creamy fleshed varieties have traditionally been used for food, feed and flour production while the leaves were used in making a national dish “Calulú”. More than thirty years of war have led to serious depletion of the sweetpotato genetic resource and reduced availability of planting material. A total of 167 advanced orange-fleshed sweetpotato (OFSP) clones and varieties were introduced into Angola from CIP Mozambique in 2008 with the aim of improving the diets of the communities with Vitamin A-rich foods as well as increasing the income of the farmers. The clones were evaluated in four sites in the highland region within the Project of Vegetatively Propagated Crops funded by the Chevron-Sonangol in collaboration with IIA’s National Program of Roots and Tubers. The sites were Huambo

province (Chianga), Huila province (Humpata and Chibia), Kwanza Norte (Quilombo) and Uige (Candande Lowé). The farmers and consumers participating in the evaluation selected nine varieties (Zapallo, Nemanete, LO326 (Camuto), LO323 (Cenoura), MUSG13 (Helena), Musg 21 (Lombe), Musg 26 (Morena), Huambachero and Mayai (Banza Luanda) based on market demand and taste of cooked roots. The varieties were later proposed for release by the Instituto de Investigação Agronómica (IIA), the research institute of the Ministry of Agriculture (MINAGRI) for production in Angola in 2012. The selected varieties were multiplied using conventional and rapid multiplication techniques in 223 decentralized plots and 7 centralized fields. The project also developed and promoted OFSP products such as Golden Bread, juice and other bakery products.

TH3ABS233

Evaluation of 64 advanced orange fleshed sweetpotato clones in 4 sites in Mozambique

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Abstract
Sweetpotato is a very important food crop in Mozambique. Due to its high nutritional value it is becoming increasingly important as a commercial crop. Considerable investment has been put in breeding since 2006 to select drought tolerant clones with high nutritional quality. In 2005 a crossing block was established with local collected materials as source of drought tolerance and introduced materials as source of Beta–Carotene. A population of seeds was collected and germinated. About 430 trials, from seedlings to multi-location and on-farm were established at four different sites involving the evaluation of 198,592 genotypes. The evaluation process was carried out during four years and lead to the release of 15 varieties. This paper describes all the selection process until the release of the 15 varieties.

Key words: sweetpotato, breeding for drought, multi-location &on –farm trial

TH3ABS220

Evaluation of dual purpose sweetpotato (*Ipomoea batatas* L. *(*Lam.*)* cultivars for roots and fodder yields in the Eastern Province of Rwanda

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Abstract
Crop residues and agro-industrial byproducts are becoming increasingly important ruminant feed resources because of increasing population pressure and fragmentation of land in Rwanda. Sweetpotato is among the food-feed crops whose potentials in household food; nutrition and income security has not been optimally exploited. Dual-purpose attributes differ among varieties of sweetpotato; and the expressions of the trait also differ with environmental conditions and management. The objective of the study was to determine the effect of cutting regimes on Dry Matter yield and nutritional characteristic of the roots and vines of selected Sweetpotato Cultivars. Six improved and two local checks were evaluated for root and vine biomass production and nutrient composition using Near Infrared Spectroscopy (NIRS) fewer than two vine cutting regimes (rationing at 80 days after planting and intact crop) in three agro-ecologically different districts in the Eastern Province of Rwanda. Results showed that ratooning at 80 days after planting nearly doubled vine yield without affecting root yields ($P>0.05$). Cultivars differed significantly among each other in vine productivity ($P<0.01$). Nutrient composition in the vines differed with respect to variety, location and cutting management. In roots, nutrient composition differed more by location than by variety. Five dual-purpose cultivars were identified. The study showed that food-feed crop such as sweetpotato can be effective protein supplements for use in feeding the lactating dairy cows in Rwanda. All the eight cultivars were dual purpose sweetpotato; especially when subjected to strategic ratooning regimes. Rapid multiplication distribution of vines of these cultivars is recommended**.** Harvesting two times at 80 intervals does not affect root yield but increases vine yields. Therefore it is the recommended ratooning regime in sweetpotato root for Food and vines for Feed in Eastern Province of Rwanda.
Keywords: Sweetpotato, vine, root, yield, cutting management, nutrient composition

TH3ABS127

Evaluation of two orange-flesh sweetpotato varieties in Bungoma County in Kenya

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Abstract
Two OFSP varieties (Kabode and Vita) have been introduced in Western Kenya through the Mama SASHA project as a food based approach of combating vitamin A deficiency. The performance of these varieties were evaluated against the locally accepted yellow-fleshed variety (referred to as Bungoma) under local conditions using three known methods of planting Flat, Mound and Ridge. Thirteen decentralized vine multipliers in four intervention sites for the project were recruited and trained to host the trials which were set up in April 2012. Data were collected over a six-month period. Each of the thirteen acted as a

replication with each having a gross experimental area of 340m^2 divided into nine plots of 30m^2 each. Each plot of 30m^2 had five rows of 5m^2 each. The design was a split-plot design, with the planting method as the main factor and the variety as a sub-factor. Vine establishment data and virus infection scores were taken at four and five weeks after planting, respectively. Harvesting of both roots and vines was done after four, five and six months of planting. At each period, one row of roots and vines was carefully harvested and weighed using a standardized spring scale. Weevil damage to roots was assessed. Cv. Bungoma had better establishment rates than cv. Kabode and cv. Vita (Median (IQR): 99 (98,100) vs. 96 (89, 98) vs. 95 (86, 98), respectively; p<0.001) across all the sites. Cvs. Kabode and Vita recorded lower virus scores compared to cv. Bungoma (Median (IQR): 1 (1, 1.2) vs. 3 (2, 3), respectively; p<0.001). On weevil damage, cv. Bungoma was superior with consistently lower weevil damage scores of 2 compared to cvs. Kabode and Vita which appeared to be susceptible with scores increasing overtime from 3 to 4. Root yield progressively increased with time of maturity for all varieties. At four, five and six months after planting, cv. Bungoma rootyields were respectively 1.8, 4.5 and 6.9 kg/5m^2; Kabode yielded 4.6,7.1 and 9.0 kg/5m^2 while Vita yielded 4.5, 7.1 and 9.0kg/5m^2. On vine yield, cv. Bungoma doubles in yield compared to OFSP. Ridge method of planting sweetpotato had the highest root yield for all the three varieties. Kabode and Vita varieties performed better than cv. Bungoma variety in terms of root yield over a 6-month period; however, cv. Bungoma was less susceptible to weevil damage.

Key words: Bungoma, Vita, Kabode, OFSP, Performance

TH3ABS049

Exhibition trial and farmer participatory selection of new late blight resistant B3C1 potato genotypes for adaptation to Nigerian conditions

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Abstract
Nineteen late blight resistant B3C1 potato genotypes received from International Potato Center (CIP) and two local checks were planted in an exhibition trial conducted in three potato growing locations on the Jos Plateau of Nigeria in the 2007 rainy season. The field trials were situated in Bokkos, Kerang and Kuru as part of the accelerated variety selection sheme (AVSS) being promoted by CIP to speed up the release of new varieties and increase adoption rate. These genotypes were planted in a randomized complete block design replicated three times in each of the locations. The objectives were to identify and select together with the farmers, high yielding and late blight resistant genotypes and by so doing, popularize these genotypes preparatory to their release. Eight B3C1 potato genotypes significantly (P<0.05) out-yielded the best check at Kuru, while 3 gave higher yields than the best check at Kerang. In Bokkos, none of the B3C1 genotypes gave significantly higher yields than the local checks. Clones 392617.54, 393073.179 and 396026.103 gave tuber yields that were significantly (P<0.05) higher than the local checks in

Kuru and Kerang with yields of 23.63, 25.24 and 19.79t/ha respectively. Based on overall performance, ten of the B3C1 genotypes were selected for further evaluation. Farmers preferred genotypes with large tuber size, fewer tubers and high yield. Few of them (3% and 6%) considered tuber colour and tuber shape respectively as important characteristics for the selection of a potato variety.

TH3ABS038

Factors that cause delays in evaluating new potato varieties for the granting of plant breeders' rights in South Africa

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Abstract
A Plant Breeder's Right is a form of intellectual property protection granted to breeders of new plant varieties. To be granted a plant breeder's right a new variety gets evaluated to determine if it is Distinct, Uniform and Stable. New varieties submitted for consideration for the granting of plant breeders' rights are compared with varieties of common knowledge or standard varieties. Test and trials based on UPOV* guidelines are employed in evaluating new varieties. Design for test and trials is based on these main morphological characteristics such as proportion of blue in anthocyanin coloration of lightsprout base, intensity and proportion of anthocyanin coloration on inner side of flower corolla and the skin color of the tuber. Certain factors which contribute to delays in evaluating new varieties have been observed. These factors include incomplete and/or incorrect information provided by breeders in Technical Questionnaires, submission of plant material that is not ready for evaluations and difficulties in obtaining standard varieties. A delay in evaluating a variety in turn delays the granting of a plant breeder's right which may have a negative impact on a breeder's morale.

*International Union for the Protection of New Plant Varieties

TH3ABS173

Farmers' potato production practices in Chencha, Ethiopia

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Abstract
A survey was conducted to understand differentiated adoption of potato production practices by smallholder farmers in Chencha district of Southern Ethiopia. Multi-stage, purposive and random sampling methods were used to select 57 potato farmers (38 adopters and 19 non-adopters) from five potential potato production areas of the district. Semi-structured and in-depth interviews were used to collect the data. The data were processed using SPSS software and analyzed descriptively and qualitatively. Six new and three old potato varieties were grown in the area. Adopters had higher level of education, higher proportion of better-off farmers and farming alone was more often the main means of livelihood compared to non-adopters. There was no significant difference between adopters and non-adopters in terms of old potato varieties farming experience. Adopters practiced different combinations of technology. Many farmers were planting seed tubers in ridges, using chemical fertilizer and storing seed in Diffused Light Storage (DLS) (26%), and planting in ridges, using chemical and organic fertilizers and storing in DLS (18%). The main sources for new varieties were institutions (82%) among wealthy farmers, and local market (57%) among medium wealthy farmers. Majority of the farmers (73%) practiced three distinct activities to prepare the land for planting: post harvest tillage, primary tillage and secondary tillage. The labour sources for preparing potato plot and potato cultivation were household members, communal labour and hired labour. New potato varieties were planted in ridges by farmers who were wealthy (77%) and medium wealthy (65%), whereas 83% of the poor farmers planted on flat soil. Old varieties were planted on flat soil by all farmers. All wealthy and 76% of medium wealthy farmers utilized inorganic fertilizers, while 71% of the poor farmers mainly used organic fertilizer. The major harvesting practice among wealthy (82%) and medium wealthy (70%) farmers was a combination of piecemeal and harvesting at once while piecemeal harvesting was the dominant practice among poor farmers (47%). Institutional support (input and training) was more common for wealthy (77%) than medium wealthy (39%) and poor farmers (6%). The findings reconfirm that potato is a well-established crop in Chencha. Better-educated and wealthier farmers adopt more of the promoted practices than the less-educated, poor and medium wealthy farmers. Factors influencing farmers' decisions need to be considered when designing successful potato technology promotion.

Key words: Potato, production practices, adoption, Chencha, Ethiopia

TH3ABS189

Genotype and phenotype variances and covariances of potato grown at Jos Plateau Nigeria

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Abstract
Genotype and phenotype variances and covariances were estimated on eight characteristics of 20 potato genotypes grown for two seasons in Jos Plateau Nigeria. The result indicated that differences among genotypes and genotypes X year interaction were significant (P= 0.05) for most characters. A large proportion of the phenotypic variance attributable to genotype variance was obtained for days to maturity and number of leaves per plant. Stems per plant had a negative correlation with days to maturity but positively significant correlation with tuber yield in both phenotypically and genotypically. This correlation analysis may provide useful information in the selection of potato genotypes with high yield and early maturing for planting in Plateau area of Nigeria.

Key words: Combined Analysis, Correlation, Early Maturity, genotype X Year interaction, genotypic variance, phenotpic variance.

TH3ABS177

How potassium and magnesium affect potato yield and quality

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Abstract
Agronomic strategies in potato production typically focus on improving yield parameters but particularly high quality of the potatoes increasingly attracts attention. However, quality of potatoes is quite a complex parameter and the desired quality traits depend on the intended usage. In addition, optimal yield and optimal quality do not necessarily correlate. In this review an overview is given on the roles of potassium (K) and magnesium (Mg) in yield but particularly quality formation in potatoes by taking advantage of results of own field trials and existing literature. For optimal yield and quality potato plants extract per ton about 5-6 kg K2O and about 10-fold lower amounts of MgO from the soil. This shows the very high demand e.g. for K but also for Mg. Due to their various functions in plant metabolism K and Mg influence yield and quality parameters in different ways. Important quality traits for

potatoes are starch and dry matter content as well as firmness and resistance against mechanical stresses e.g. during harvest. These quality traits are closely interrelated and it has been found that all of these parameters are also closely linked to the K content of the tubers. Particularly the K form, which if applied, affects e.g. the starch content where the sulfate form increases and the chloride form decreases the starch content. Another important factor is the turn to formation of discolorations in both fresh market and processing potatoes. In principle enzymatic and non-enzymatic processes cause such undesired discolorations like ´black spot incidence´ or ´after cooking blackening´. Whereas high ascorbic acid and citric acid contents reduce discolorations in fresh market potatoes, the reducing sugar content should be reduced in processing potatoes to a minimum in order to avoid discolorations and accumulation of human toxic acrylamides during deep frying. A proper K nutrition of potatoes was shown to increase the ascorbic acid and citric acid content, whereas the content of reducing sugars is reduced. In conclusion potato has an extraordinary high demand for K. Not only fresh market but also processing potato production in appropriate quality strongly depends on continuous K but also Mg supply throughout growth. Therefore, fertilization recommendations should be made site-specific and should strongly depend on the present soil K and Mg contents, the intended usage and the expected usage of the potatoes.

TH3ABS013

Maize – orange-fleshed sweetpotato (OFSP) intercropping: potential for use to enhance food security and the scaling-up nutrition effort in Malawi

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Abstract
Maize is the staple food in Malawi where it is mainly cultivated by smallholder farmers under rainfed conditions. Due to increasing climatic uncertainty and declining soil fertility, crop failures often result in shortages affecting up to 1.6 million people every year. An estimated 47% of the children in Malawi suffer from stunted growth because of under-nutrition, and are vulnerable to illnesses and learning difficulties. Crop diversification is at the core of Malawi's agriculture policy. Nutrition act and new crops are at the centre of the Malawi Government's attempts to overcome the effects of annual food shortages. The Rooting out Hunger in Malawi with nutritious orange-fleshed sweetpotato project funded by the Irish Aid has been working with partners since 2009 in Malawi, and has made greater strides in popularizing this type of sweetpotato. The potential of the OFSP cultivar Zondeni, in contributing to sustainable intensification of a maize-based cropping system as an intercrop was investigated. Maize-sweetpotato intercropping trials were conducted in two consecutive rainy seasons at Bvumbwe Agriculture Research Station in southern Malawi. Four spatial arrangements were compared (2 rows OFSP/1 row maize, 1 row OFSP/1 row maize, 1 row OFSP/2 rows maize, and 3 OFSP/1 maize plant within the same row) in large plots. Trials, each with three replications, were repeated each year, with maize harvested at 4 months and OFSP harvested at 5, 6 and 7 months after planting. In year 2 land equivalent ratios

(LER) were determined, while in both years, farmers were interviewed about their assessment of performance of the trial, and gross margin analysis was conducted based on yield results. Gross margin analysis indicated that OFSP/Maize intercropping was highly profitable in both years, with sweetpotato accounting for > 90% of income. In the second season trial, yields were much lower than in the first year, and more typical of farmers' conditions in Malawi. In this trial, LER was 1.79 over all spatial arrangements, indicating high potential of OFSP/maize intercropping for sustainable intensification in Malawi. Farmers' rank preferences for OFSP/maize spatial arrangements shifted from year 1 to 2 with the higher OFSP-density (2 rows OFSP/1 row maize) arrangement preferred in year 2. The marked absence of sweetpotato weevil damage from OFSP/maize intercrops was noted in both years. Results are discussed and recommendations made for future on-farm testing and dissemination of OFSP/maize intercropping in Malawi.

Keywords: intercropping maize-sweetpotato, OFSP, low-input systems, sweetpotato weevils, scaling-up nutrition, food security.

TH3ABS183

Mitigating negative drought effects on sweetpotato productivity through tolerant cultivars in Kenya

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Abstract
Global warming is increasingly causing perpetual drought thus reducing crop yield significantly in sub-saharan Africa, despite increasing human population and diminishing farm sizes. However, some cultivars in some crops such as sweetpotato may exhibit drought tolerance. A study of 84 sweetpotato clones obtained from the genebank of Kenya, International Potato Centre (CIP) and farmers' fields, to determine their tolerance to drought was conducted at Kenya Agricultural Research Institute (KARI), Kiboko and Thika sites under drought and optimal moisture managed environments between May 2011 and September 2012. The experiment was laid out in a split plot design and was replicated twice and repeated two times. The study was validated in greenhouse box experiments at KARI Muguga using a randomized complete block design (RCBD), replicated five times and repeated twice. In greenhouse experiments, 15 cm long shoot cuttings were inserted 5 cm deep in boxes filled with 45 cm deep sterile soil spaced at 10x10 cm, and moisture maintained at field capacity up to 15 days after planting. In field experiments; 30 cm long cuttings were planted 10 cm deep on 25 cm high beds, in single lines of 6 hills spaced at 30x90 cm and standard agronomic practices followed. Data on root dry matter (RDM), marketable storage roots (MSR), vine dry matter (VDM) and days to permanent death (DPD) were taken and subjected to analysis of variance. Harvest index (HI) and drought sensitivity index (DSI) were also determined. The RDM, MSR, VDM, DPD and HI were highly significantly different among cultivars and environments (P=<.001). The drought

environment had significantly lower VDM, RDM, MSR, HI and DSI. Nine cultivars Bikra Maria, 421066, Gatumbi, 420014, A2, Nyatonge, 1990621, Chingovu and 194555.7 performed well in both water stressed and non water stressed environment and had RDM, MSR, VDM, DPD and HI and DSI of 8.8, 20.1 2.7 69.6 0.8 and 0.90 respectively. These cultivars had DSI <1 and took fewer DTD which indicates they could be drought tolerant and stable across environments. These cultivars may be grown in areas with unreliable rainfall or incorporated as parents in breeding programs towards improved drought tolerance in Kenya.

Key words: Water stress, tolerant, yield, cultivar

TH3ABS111

New elite potato clones with heat tolerance, late blightand virus resistance to address climate change

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Abstract

Potato production in developing countries is expanding to warmer environments in search of income opportunities and food security. Meanwhile, climate change is already affecting weather patterns in traditional potato growing areas, where unpredictable rains and pressure from pests and disease are increasing farmers' risk. Since 2004, CIP has sought to develop new, more heat-tolerant generation of its tropical highland adapted late blight resistant population. Late blight resistant parents were crossed with early maturing and virus resistant progenitors, and selection practiced under warm temperatures, water deficit, and mid-latitude conditions. 20,000 genotypes were exposed to heat in a screen house during the summer season (January to March) at CIP's experimental station in San Ramon, a warm rain forest environment at 800 masl and 11°08'S. Selected clones were assessed in the field in the same location,where average night and day temperatures were 21and 27°C, respectively, during tuberization, There sulting heat tolerant clones were exposed to high, endemic late blight pressure in Oxapampa (mid-elevation humid tropics) in replicated trials conducted overfour years. Selected heat tolerant, late blight resistant clones were evaluated for yield components in thespring-summer season in La Molina (12° S) and drought sensitivity in Majes (17° S) along the arid coast of Peru. 61 advanced clones were assessed again for yield in San Ramon, La Molina and Majes and yield stability analyzed, all trials were conducted in a simple lattice design, using Desiree as a heat tolerant control. Harvesting was performed at 90 days. The 61 clones were screenedfor resistance to PVX and PVY by mechanical inoculation and grafting. Analysis of variancefor marketable tuber yield showed significant differences among clones.In San Ramon, yields were in the rangeof 16.01 to 28.43t/ha significantly exceeding the control. Of the 40 eliteclones selected from the new 'LB-HT' (for late blight-heat tolerance) group, 11 carry extreme resistance to PVY, 25 to PVX, and 10 show tolerance to drought. Eleven mid-maturing clones with heat tolerance, resistance to late blight and PVY suitable for mid-elevation zones and climate change, and 40 mid-maturing clones with resistance to late blight are available for variety development and further use in breeding.

Key words: Potato, clones, Late blight, heat, virus, CIP

TH3ABS174

Participatory evaluation of CIP potato germplasm in Kenya

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Abstract
Potato variety release mechanisms in Kenya have received considerable criticism for not paying sufficient attention to the conditions and preferences of farmers in less favourable areas. Yield performance is given considerable weight compared with farmer and market-preferred traits such as earliness, short dormancy and suitability for low input farming systems, cooking quality, taste, marketability and storability under traditional farming systems which have led to low variety adoption rates in the region. The objective of the study was to find out the local preferences and selection criteria the farmers use when adopting a new variety. Participatory evaluation and selection of International Potato Centre (CIP) clones were conducted in potato producing areas in Kenya in different agro-ecological zones. Selected advanced clones were evaluated on-farm using an existing guide for Participatory Variety Selection (PVS) from CIP. Evaluations were done at the vegetative stage of growth and harvest to determine farmers' desired characteristic. Evaluation panel of male and female was selected from various stakeholders in potato industry attending farmers' field. Panel voted for their preferred characteristics of potato crop during vegetative stage while yield and organoleptic evaluations were done at the time of harvest. The number of stems per plant and tall and vigorous plants were voted as the most preferred characteristics in potato plant at the vegetative stage. For yield and organoleptic properties initial results show that clone 392797.22 was preferred for higher yield and clones 398098.65 and 392617.54 were liked for good taste. The data collected in this study will be useful in identifying new potato varieties for release in different areas as per the farmers' preferences. Hence participating farmers in potato variety evaluation would increase adoption; as farmers select varieties that satisfy their preferences, suits their environment and also meet their socio-economic situations. The opinion gathered on the preferred characteristics could also be used in breeding to produce varieties with desirable characteristic most likely meet the needs of farmers.

TH3ABS185

Participatory farm-level innovation in bacterial wilt control

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Abstract
At 2100 metres above sea level, the Shashemene pilot has a temperate climate and ideal for cereals and Irish potato. There are two cropping seasons, the first runs from February to April (the short rainy season) and the second from June to October (the main season).

Farmers often fail to grow potatoes in the main growing season owing to late blight and bacterial wilt incidences in the main potato crops. A technology development and dissemination activity was undertaken by using the modified Farmers Research Extension Group (FREG) approach to develop potato technologies suitable to local conditions. The purpose was to assist farmers in developing healthy potato farms, which are more productive, profitable, and sustainable. Using this approach, experiments including varietal evaluation, the natural variability of potato clones in response to major potato diseases such as late blight, the role of crop rotation in reducing the incidence of bacterial wilt and the contribution of the use of disease free seed on limiting disease dissemination and tuber yield were tested with the full involvement of farmers' research group. The research activities were supported by sessions harmonized with crop phenology. The modified FREG approach was found to be effective in stimulating farmer participation by considering their goals in the targeting and design of innovations. Before the inception of the project, more than 90 % of the farmers were not aware of the causes of potato diseases. Most of the farmers do not have the basic knowledge to differentiate symptoms caused due to insect damage and/or infection by pathogens. Regarding diseases, most of the farmers (95 %) believe that any type of disease is caused by rain and frog whereas; others don't even guess the causes. At the end of the season after subsequent sessions, and demonstration at field level, farmers were able to change their views and understanding about the causes of diseases and potential control measures. Currently the majority of the farmers who participated in the farmers research extension groups know the causative agents of potato wilt, late blight, viruses and damage caused by potato tuber moth and aphids and are also able to differentiate symptoms. Moreover, after two seasons, more than 65 % of farmers in the group knew the life cycle of the major pathogens and major insect pests of potato. Concurrently, farmers acquired knowledge on how BW and LB are disseminated and about possible control measures of potato bacterial wilt and late blight.

Key words: FREG, bacterial wilt, late blight, potato

TH3ABS154

Participatory variety selection approach for fast adoption of varieties in Bhutan, Nepal and Bangladesh

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Abstract

The existing traditional selection system of varieties in South Asia has a major limiting for slow adoption rate of new varieties due to low participation of diversified stakeholder such as farmers, consumers, processors, cold store owners, private sector, and NGOs at different stages of the crop. The majority of the varieties released by the National Programs are not adopted due to low acceptability by farmers and consumers. The participatory variety selection (PVS) can help as an effective tool for new varieties or technologies dissemination and up-scaling with equal participation of women and also in systematic assessment of preference by farmers for the characteristics required in new cultivars which can lead to fast adoption. The PVS encompass the mother and baby trial design adapted by International Potato Center (CIP) for simultaneous evaluation by farmers and research programs. The CIP has introduced the PVS concept to release potato varieties in Bhutan, Bangladesh and Nepal. The multi-stakeholders to be associated directly or indirectly for selecting varieties through M & B design were trained in Bhutan, Nepal and Bangladesh in 2012. Through such

trainings, the farmers are acquainted with new clones/varieties from the vegetative stage to harvesting/post-harvesting and also knowing the taste of the new potatoes through organoleptic assessment. Farmers and researchers' reaction and point of view for selection of a variety and perception of each other's information level about potato research were discussed. The trainers were enthusiastic about the new approach to release varieties through their involvements at different levels and suggested that the training duration should be longer, and separate training should be conducted for farmers and researchers. The CIP elite clones received by Bhutan Potato Development Program, National Potato Research Program, Nepal and an NGO, LI-BIRD evaluating through "Mother trials" in a scientific manner at research stations and "Baby trials" by farmers using their own practices. The "mother trials" to test and demonstrate the value of disease resistance, and farmer led "baby trials" will expose the candidate clones for farmers' management practices. The implementation of PVS approach reduces the time taken to release the variety from existing traditional system of 8-10 years to 4-5 years, and enhance acceptance rate of released varieties.

TH3ABS005

Performance of local sweetpotato germplasm in the Solwezi District of Zambia

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Abstract

Sweetpotato is one of the most important sources of carbohydrates among small-scale farmers in Zambia and ranking second only to cassava. It performs well in poor soils lacking sufficient nutrients and water and thrives in fertile environments where yields exceed those of cereal crops (Woolfe, 1992). A study was conducted under field conditions at Mutanda Research Station during the 2011 and 2012 season. Mutanda Research Station is in the agro-ecological region III (altitude 800-1300m a.s.l., rainfall in the range of 800-1200mm and has acidic soils of pH 4.5-5.1). This study was conducted to evaluate and maintain local Germplasm for subsequent use in the breeding programme and to avoid genetic erosion of local cultivars as a result of continued use of released varieties. Fifteen clones on the basis of germination, number of roots produced and yield were evaluated in a randomised complete block design with three replications. The results obtained showed that there was no significant difference (P≤0.05) among clones with regard to germination. There were significant differences (P≤0.05) among clones with regard to non commercial tubers. The variety Chingovwa had a lot of non commercial tubers followed by Matembele at 13.3 and 13 tubers per plot respectively while Chisenga and Chitobenge had few non commercial tubers at 3.3 and 4 tubers per plant. There were significant differences (P≤0.05) with regard to number of commercial tubers. Chingovwa had more commercial tubers followed by Lunga at 32 and 31 tubers per plot respectively while Chilubi and Kalukuluku 1 had few commercial tubers at 14 and 15 tubers per plot. There were significant differences (P≤0.05) with regard to yield. Chingovwa and Lunga produced a lot of tubers at 27.3 t/ha and 23.1 t/ha respectively, while Matuwa and Ukerewe produced few tubers at 9.8 t/ha and 11.5t/ha respectively. Sufficient variation exists among the local clones for non commercial tubers, commercial tubers and yield to allow for identification of superior local germplasm for subsequent use in the breeding programme. Agronomically, the materials tested revealed that varieties with combination of suitable characteristics are identifiable. Chingovwa and Lunga were identified as the best varieties for production on the basis of levels of yield and other agronomical performance.

Key Words: *Ipomoea batatas, evaluation, yield, local germplasm, Zambia*

TH3ABS096

Production of virus free sweetpotato planting materials using insect proofed net cover technologies

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Abstract
Sweetpotato (*Ipomea batatas)* is one of the most important staple crops in densely populated parts of Eastern Africa and is quickly becoming an important supplementary staple in the southern part of the continent. One of the major yield limiting factors in sweetpotato production are lack of clean planting material owing to infection of Sweetpotato virus diseases (SPVD). Several control measure of sweetpotato virus have been studied including planting of varieties tolerant to SVPD and maintaining healthy vines on farmers field through phyto-sanitation and control of vector population, however studies on alternative low cost method of maintaining virus free planting material have not been studied. An experiment with aphid proof net cover technologies was set from June 2009 to January 2012 at the KARI research station in Kakamega, Kenya. The experiment was laid out as a two factorial randomized block design replicated 4 times. Factors were following: a) Exposed control; b) Net cover – laid on 40cm high pegs; c) Net tunnel- 140cm height. Three varieties of sweetpotato free from virus but susceptible to SPVD were planted. Virus test were conducted using NCM-ELISA. Data was generated from 6 vine cuttings, at a 5 months interval. Cuttings were replanted to measure root yield performance. Results show significant reduction in aphid, white fly population and virus levels and a significant higher production of vine cuttings (25-58%) from the second cutting onwards in net cover technologies compared with the control. However, the planting material yield in the net cover treatments were significantly lower compared to the net tunnel due to vine damage caused by accumulated heat due to limited aeration. Virus incidence in the exposed control significantly increased by every harvest, whereas vines from net cover treatments remained in a good health status even at 30 months after planting. Further studies on root yield effects of vine qualities derived from the treatments; reveal a yield advantage of 40-120% when planted with vines from the cover technologies, underscoring the importance of healthy planting material. In conclusion net cover technologies tested are effective and sustainable for the conservation of healthy planting stocks. However, the net cover technology showed disadvantages in aeration which led to a damage of parts of the vines therefore, the net tunnel cover should be preferred.

Keywords: Sweetpotato (*Ipomea batatas),* healthy planting material stocks, net cover technology

TH3ABS017

Root knot nematodes and soft rot enterobacteriaceae, two emerging problems of potatoes

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Abstract
The soft rot *Enterobacteriacea* (SRE) and root knot nematodes (RKN) are two important pathogens of potatoes and other crops globally. With the advancing use of molecular-based technologies for identification and evaluation of genetic diversity of many pathogens, new and threatening species of RKN and SRE are constantly being identified. In our research, we have employed the use of PCR-based diagnostic tools to conduct surveys of the different SRE and RKN infecting potatoes in South African potato fields. Results from our survey indicate that there are other SRE which have previously not been reported which are emerging problems of potatoes globally. These include *Pectobacterium wasabiae* which we have identified in some potato producing farms in South Africa. *P.wasabiae* was first isolated from horse radish in Japan, and since then, it has been isolated in the USA, New Zealand, Iran and Canada. It is thought to be an emerging problem of potatoes worldwide, but recent reports suggest that its occurence in Europe might be wider than previously thought. We also conducted a country wide survey of RKN and identified the presence of the three main tropical species, namely *Meloidogyne javanica* (24%), *M. incognita* (23%) and *M. arenaria* (17%). Our study further established the presence of the more temperate species such as *M. chitwoodi* (3%) and *M. hapla* (1%) of the samples tested. Of significant interest was the identification of *M. enterolobii* (constituting 13% of the tested samples) in some potato producing regions. This is a highly virulent species known to break resistance such as that encoded by the Mi-gene of tomatoes. In the survey, RKN samples were also profiled according to the cultivars from which they were isolated. The most number of RKN were isolated from Mondial (61%) followed by Up to date (14%). RKN samples were isolated from other cultivars including Sifra, Buffelspoort, Argos, Fianna, Valor, BP1 and Van der Plant (1 – 5%). RKN are known to form synergies with other pathogens in the soil, leading to increased incidences of disease. To determine whether such synergy exists between RKN and SRE, we developed mCherry reporter fluorescent proteins tagged *Pectobacterium* strains. With the aid of this tool, we were able to show that presence of RKN in the soil can facilitate entry of *Pectobacterium spp* into potato tubers, leading to latent infection.

TH3ABS230

Screening sweetpotato (*Ipomoea batatas* L.) for drought tolerance and high β-carotene content in Mozambique

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Abstract
Sweetpotato (*Ipomoea batatas,* L.) is one of the most important food sources and an option for rural income generation in Mozambique. The crop is produced mainly by small-scale farmers under rain fed conditions. Drought is the most important abiotic stress in southern Africa. It affects yield and conservation of planting material *in situ* for the next growing season. The objective of the study was to identify sweetpotato genotypes tolerant to drought, particularly orange-fleshed genotypes, to be used as new parental material in the breeding programs. Forty eight genotypes (12 landraces, 23 introduced clones and 13 national breeding lines) were evaluated in field trials conducted at Umbeluzi Research Station using a three replicate, α-design with split-plots. The factor treatment were three irrigation levels, namely: (i) no stress (plants irrigated from planting), (ii) moderate stress, plants irrigated until 60 days after planting (DAP), and (iii) severe stress, plants irrigated until 30 DAP. Results indicated that genotypes differed significantly in their response to irrigation levels for total root yield. The national breeding lines and introduced genotypes had higher yields than the landrace genotypes. The mean of dry matter yields across irrigation levels of the national breeding lines and introduced genotypes were higher than those for the landrace. Most of the national breeding lines had higher β-carotene content than the introduced material and landraces. The landraces had higher storage root dry matter compared to national breeding lines. Under moderate stress, the stress tolerance index (STI) for total yield separated the 48 sweetpotato genotypes into three groups: drought tolerant (high STI, 8 clones); moderately drought tolerant (intermediate STI, 6 clones); and drought sensitive (low STI, 34 clones). Under severe stress, the STI for total yield separated the 48 sweetpotato genotypes into three groups: drought tolerant (high STI, 8 clones); moderate drought tolerant (intermediate STI, 5 clones); and drought sensitive (low STI, 35 clones).

Key words: drought, genotypes, irrigation levels, moderate and severe stress

TH3ABS128

Seed and ware potato production characteristics of Eastern Uganda

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Abstract
Potato is a national priority commodity for improving livelihoods of the people on the slopes of Mt. Elgon in Eastern Uganda. This paper discusses the characteristics of production practices of potato farmers involved in both ware and seed production. It is based on a diagnostic study carried out in January 2012 to generate information on the status of potato production in six districts along the slopes of Mt. Elgon where potato is predominantly grown after Kigezi highlands. Average farm sizes ranged from 0.1 to 15ha with 72% cultivated with potato. Potato was ranked 1 by 55% of respondents among income generating crops and a 3rd family food source. Potato has been grown on average for 11 years and is produced 2 times a year. The most common variety is Cruza which was released in Uganda in 1995. Rotation crops with potato include wheat and barley in Sebei zone whereas beans and maize are used in rotation with potato in Bugisu. Seed is sourced locally from neighboring farmers/markets although some elite producers access it from the Potato centre in Kabale and Sub centre in Buginyanya ZARDI. The poor access and availability of sufficient seed causes it to cost UShs 300 to 2400 Per Kg on the open market. The high cost limits use of quality clean seed potato and therefore predisposes farmers to bacterial wilt which is compounded by poor control of potato blights. Most of the commercial producers use chemical control for the blights but this was not supported by the ability to identify symptoms of the diseases. Victoria an elite variety with more uses attracts a premium price compared to Cruza another popular but local variety. Only 60% of the farmers apply fertilizer at least once during the crop cycle. The study therefore showed a high deficiency in access and availability of quality seed potato which has limited the potential for improved livelihoods. Buginyanya ZARDI and partners have initiated projects aimed at increasing the capacity of farmers to produce quality seed potato, access to market and knowledge in integrated management of soil fertility, pests and diseases of potato.
Keywords: Bacteria wilt, seed potatosystems, marketing

TH3ABS016

Segregation and expression analysis of cry7aa1 gene in F1 progenies of transgenic and non-transgenic sweetpotato crosses

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Abstract
Sweetpotato weevils are the most devastating pests of sweetpotato causing yield losses ranging from 60-100%. Their cryptic nature, where the larvae are found within plant tissues render them difficult to control especially using chemical means. Host plant resistance is more economical for farmers in Africa but rely on the availability of a good source of resistance. We have introduced *cry* genes into sweetpotato to confer resistance against weevils. As a test study, we have investigated the transmission of this resistance locus in progeny. We crossed a transgenic event CIP410008.7 (*cry7Aa1* gene) as a female parent with three Ugandan cultivars as male parents. Progenies with New Kawogo (partially resistant to weevils), Tanzania and NASPOT1 gave 57, 32 and 19 seeds respectively. A total of 86 F1 progenies were analysed for the presence of *cry7Aa1* using PCR. The expected 608 bp amplicon was observed in progenies that contained the *cry* gene. Segregation analysis was conducted in the F1 progenies of different families: CIP410008.7 x New Kawogo (47.2%), CIP410008.7 x Tanzania (52%) and CIP410008.7 x NASPOT1 (44.4%). Chi-square test showed that all the three families followed a 1:1 segregation *cry7Aa1* gene ratio (50% *cry7Aa1* segregants and 50% null segregants). Further molecular analysis will be conducted on the largest progeny (deriving from New Kawogo) to ascertain the *cry7Aa1* gene expression in the F1 sweetpotato and Cry7Aa1 protein accumulation quantification using DAS-ELISA. The resistance to weevils will also be tested in order to assess whether the resistance locus of CIP410008.7 and others from New Kawogo had an additive effect. This data set represents a step forward in the transfer of sweetpotato genetic engineering technology from model varieties to elite breeding lines.

Keywords: weevil resistance, transgenic plants, sweetpotato, *cry* gene, Bt crops

TH3ABS188

Selection criteria for potato (*Solanum tuberosum* L.) breeding

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Abstract
Twenty Potato genotypes which were collected from different locations were studied to determine the relationship among yield and some yield components of potato using correlation and path co-efficient analysis. The experiment was conducted at the research farm of the potato programme of National Root Research Institute, Kuru, Plateau State, Nigeria during the 2006 and 2007 cropping seasons. The experimental design was a randomized complete block with three replications. Results indicated higher magnitude genotypic correlation coefficient than the corresponding phenotypic estimates thereby indicating that there is a strong inherent association between these characters. Positive and significant genotypic relationships were found between tuber yield and plant growth habit, plant height, emergence counts, tuber number, days to maturity and average tuber weight, A positive and non-significant relationship was determined between tuber yield and inter-node length. According to the path-coefficient analysis, there were strong positive direct effects of number of leaves per plant, number of tubers per plant, number of eyes per tuber per plant and plant height. PC: 0.2163, 0.1337, 0.12619 and 0.0663 respectively. Based on the magnitude and consistency of parameters for various characters it was concluded that simultaneous selection for number of tubers per plant, plant height, plant growth habit, number of leaves per plant, average tuber weight would be effective in improving tuber yield in potato.

Key words: potatoes, path co-efficient, correlation, yield and Yield components.

TH3ABS061

Sensory evaluation and consumer acceptability of sweetpotato genotypes by youths in Omu Aran, Kwara state, Nigeria

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Abstract
The purpose of this study was to evaluate consumers' acceptability of four orange-flesh sweetpotato (OFSP) genotypes (440034, 199024.2, Blesbok and 199034.1) and seven yellow-fleshed genotypes (W-15.1, Ex-igbaran, Shaba, NASPOT5, Barth, 440215 and Santi) newly introduced to Omu-Aran community. Youths between 17 and 25 years of age in Landmark University, Omu Aran, Kwara State, Nigeria were selected for this purpose. These genotypes were germplasm collection of the Department of Agronomy, University of Ibadan, Nigeria. All respondents were selected on the basis of their awareness and consumption of sweetpotato. Forty two youths (26 males and 16 females) who were conversant with the taste of sweetpotato were purposively selected. Harvested sweetpotatoes of various genotypes were boiled two days after harvesting and each of the sweetpotatoes variety was sliced and served to the youths. All the genotypes were cooked at once using polythene bags to demarcate them in the cooking pot. After eating one genotype, water was used to rinse their mouths before proceeding to another. The attributes evaluated include sweetness, consistency, texture and acceptability. Data analysis was carried out using frequency counts, percentage, mean, standard deviation and correlation. Out of the eleven genotypes, Blesbok and 440034 of orange flesh were highly consistent, moderately sweet and the texture was highly acceptable, while 199034.1 was the least fibrous among the genotypes. Comparing the scores of the all varieties presented for sensory evaluation, the preferred variety in terms of consumer acceptability was Blesbok. Conclusively, youths in Omu-Aran, Kwara State, Nigeria prefered Blesbok above all other varieties because of its colour, sweetness, consistence, low fibre content and high vitamin A. It is recommended that policy makers, research institutes and Non-Governmental Organisations should intensify efforts towards the propagation of this variety by ensuring its massive dissemination to farmers by extension agents.

Keywords: Acceptability. consistence, genotype, propagation, sweet-potato, sweetness, texture.

TH3ABS025

Soil and potato nitrogen status and use of spad meter in nitrogen management in Kenya

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Abstract
Potato is a major crop in Kenya with its production being in the highlands. The production area is increasing as a result of people stopping cultivation of other crops and opting for potatoes. The production per area is however lower than what is expected due to several challenges, one among them being the poor fertilizer management. A survey conducted to find the fertilizer use and crop nitrogen status indicated that 78% of farmers use fertilizer and 90% of those using the fertilizer applied below the recommended rate of 90 kg of nitrogen (N) per ha. However the leaf samples from the farmers field indicated only 42% of farms were below the 4.5% N level in the leaves which means lower yields at harvest. The differences could be explained by the use of foliar fertilizers and also adequate nitrogen level as indicated by the soil analysis from the same farms. A split-plot experiment was conducted at the University of Nairobi Kabete Campus farm using Asante and Tigoni potato varieties with three NPK (17:17:17) fertilizer levels (45, 90, 135 N kg/ha) and a control with no fertilizer application. The aim of the experiment was to relate the potato shoot nitrogen concentration to the chlorophyll meter (SPAD) reading. Correlation between total nitrogen and the SPAD index was 0.61 while probability was <0.001 for the means of the above ground dry matter at 0.05 significance level. A linear relationship between shoot nitrogen content and the SPAD index was established for the two seasons with r^2 of 0.45 and 0.51 respectively. The correlation between total nitrogen and SPAD reading means that extension can use the instrument to advice farmers on fertilizer management

TH3ABS211

Stability of selected sweetpotato clones fresh yield, harvest Index and reaction to virus, *Altenaria spp* and weevil stresses in Uganda

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Abstract
Eleven sweetpotato genotypes were evaluated at four locations for yield and reaction to sweetpotato virus disease (SPVD) during 2009 and 2010. The trials were aimed at investigating the genotype (G) x environment (E) interaction effects on yield, SPVD and Alternaria resistance and to identify stable clones for the traits. From the additive main effect and multiplicative interaction (AMMI) analysis the clones were very unstable for yield but stable for SPVD. The clones had mean yields > 10 t/ha. Clone 23/60/90 (17.3t/ha) gave the highest fresh yield across locations; 23/60/90 and Zapallo/94/7 were most resistant to SPVD. The results suggest that breeding for enhanced yield in sweetpotato requires early testing in multi-environments to identify genotypes with specific adaptation. On the other hand, selection for SPVD can be reliably done at a single location. Also, it is important to evaluate genotypes for more than two years to ascertain their performance at a location given the differences in behavior of locations by the years.

TH3ABS131

Studies on some important consumer and processing traits for breeding sweetpotato for varied end-users

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Abstract
Fourteen advanced sweetpotato lines with varied genetic backgrounds were evaluated for processing quality traits such as dry matter, starch yield, flour yield and peel loss. Correlation analysis among the traits was carried out. Fresh roots from same materials were also boiled and fried. Sensory evaluation was carried out on the products using selected panelists. Forward selection multiple regression analysis was performed on the sensory variables to identify the culinary traits that most influence boiled and fried sweetpotato roots. ANOVA showed that there was significant ($P<0.05$) variation among the 14 advanced lines for dry matter, starch content, flour content and peel loss. Dry matter (on wet basis) ranged between 24.16 and 34.17% while starch content was between 17.58 and 22.0%. Flour yield and peel loss ranged between 21.34 and 32.32%, and 18.17 and 24.01% respectively. Correlation studies among the processing traits showed dry matter had significant ($P<0.05$) correlation with starch and flour yield only. ANOVA for boiled sweetpotato roots showed significant ($P<0.05$) differences among the genotypes for root colour and general acceptability. For fried sweetpotato roots, the genotypes showed differences ($P<0.05$) for root colour, mouth-feel, taste, aroma and general acceptability. The forward selection multiple regression analysis identified aroma, mouth-feel and root colour as important traits that influenced panelists' acceptability for boiled roots. As for fried roots, only root colour and taste were of significant contribution to acceptability. The work has helped in identifying traits that could be employed in breeding acceptable sweetpotato varieties for fresh root consumers and processors for market integration.

Keywords: sweetpotato, regression sensory processing dry matter flour starch.

TH3ABS079

Sweetpotato virus disease research and diagnostic tools development at the Kenya Agricultural Research Insitutute Biotechnology Centre

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Abstract
Sweetpotato, *Ipomoea batatas* (L.) Lam. (Convolvulaceae) is an important global food crop. It is among the most important food crops in the world and is ranked seventh based on total production and the fifth most important crop in developing countries. It is a valuable source of vitamins and other micronutrients, especially its storage roots, which contain carotenoids the precursor for β-carotenoids. It's often crucial during famine, due to its rapid production of

storage roots following the onset of rains and this makes it a good food security crop in marginalized areas. Sweetpotato production is affected by virus diseases including sweetpotato feathery mottle virus (SPFMV), sweetpotato mild mottle virus (SPMMV), sweetpotato latent virus (SPLV), SPCFV, SPCSV and sweetpotato leaf curl virus (SPLCV). There has been poor continuous screening of the viruses to determine distribution and germplasm resistance/susceptibility and development of diagnostic tools. Sweetpotato germplasm collected countrywide (Kenya) and established at KARI Biotechnology center's green houses. Nitrocellulose membrane ELISA (NCM) was performed except for SPLCV; samples were blotted, antibody applied then followed by 1 hr incubation. Conjugate antibody was added and incubated for 45 min then washed and developed. Purple color indicated positive sample. For SPLCV, PCR was done using degenerate primers (SPB, SPG and PW) were used. PCR protocol was optimized; MgCl2 (1.5mM), dNTPs's (1Mm) Taq buffer (0.2x), 0.6pmls of forward and reverse primers and 0.1U/µl of Taq polymerase. This was applied to all degenerate primers for SPLCV. SPLCV is also present in all regions of the country. These viruses are still prevalent in the country and there is need for further breeding and characterization to obtain resistant germplasm. PCR and NCM disease diagnostics tools has been deployed at the centre and clean materials multiplied through TC. Optimized protocols for SPLC virus is also shared with other laboratories. Ongoing work is to establish the susceptibility of sweetpotato local germplasm to these viruses.

Keywords: sweetpotato viral diseases research, diagnostic tools; PCR and NCM, resistance/susceptibility, local germplasm characterization.

TH3ABS018

Sweetpotato and garden egg intercrop compatibility studies in Umudike, Nigeria

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Abstract
This experiment was conducted at Umudike, (Lat 05°29'N, Long 07°33'E) in the tropical rainforest agro-ecological zone of Nigeria to determine the compatibility of sweetpotato (*Ipomoea batatas*) and Garden egg (*Solanum aethiopicum*) intercrop. Two Sweetpotato varieties (NRSP 05/022 and TIS/87/0087) each planted at 1m x 0.30m were intercropped with garden egg at three different plant spacing of 1m x 0.5m, 1m x1m, 1m x1.5m. The experiment was laid out in a randomized complete block design. Sweetpotato vine length and leaf number were measured at 8 and 12 week after planting. Garden egg height, leaf number and number of garden egg fruits /plant were also measured at the two periods. Sweetpotato was harvested and the root yields measured at 16 WAP while garden egg fruits were harvested from 60 to 90 DAP and the yield summed up. Intercropping sweetpotato and garden egg significantly (P< 0.05) led to increase in sweetpotato vine length and reduced number of leaves. Intercropping with TIS/87/0087 reduced significantly the plant height of garden egg. NRSP 05/022 gave higher root yield than TIS/87/0087. Intercropping at the three populations of garden egg did not affect garden egg fruit yield (P>0.05). Intercropping sweetpotato with garden egg resulted in higher land equivalent ratio (LER) over sole cropping of either sweetpotato or garden egg. LER greater than 1 was obtained for sweetpotato variety NRSP 05/022 intercropped with garden egg at 1m x 0.5m, 1m x1m, 1m x1.5m thus suggesting that both were compatible.
Keywords: Sweetpotato, Garden egg, Intercropping, Compatibility, Growth, Yield

TH3ABS235

The driving for the rapid adoption of new sweetpotato varieties: Evidence from baseline survey and rapid appraisal conducted in Mozambique in 2012

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Abstract
Fifteen new varieties orange fleshed sweetpotato were released in 2011 in Mozambique. Several activities on the seed systems were put in place to deliver the vines in order to increase production and consumption of orange fleshed sweetpotato. This paper discusses the most important features that have been linked to the rapid adoption of the new sweetpotato varieties in Mozambique. Data from a baseline survey and information from different rapid appraisals conducted during the first two years of multiplication and distribution is used to support the discussions. One finding indicated that the rate of adoption of sweetpotato is significantly dependent on other specific factors rather than solely on the robustness of the varieties.The local uses and customs continue to have a considerable influence in the adoption of sweetpotato.

Keywords: sweetpotato, adoption of new varieties, context specificity, variety robustness versus local uses and customs

TH3ABS234

The effect of intercropping sweetpotato with pigeon pea on the yield

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Abstract
Two varieties of sweetpotato, Resisto and Jonathan were intercropped with middle maturity pigeon-pea and the effect on yield was studied over three years (2008-2010).The treatments were: Resisto, Jonathan and pigeon peas as monocrops, Resisto and Jonathan intercropped with pigeon pea in the same row and in alternate rows. Pigeon peas were harvested 2.5 month after the harvest of sweetpotato. Although there was no significant difference (p=0.064, alpha = 0.05) between yield of sweetpotato in both monocrop and intercrop, the yiield of sweetpotato intercropped with pigeon peas was superior than the yield of sweetpotato as monocrop. The best yield was obtained with Resisto when planted in alternate row (6.10 t/ha), and was significant (p=0.04, alpha = 0.05) when compared with Resisto planted in monocrop (4.79 t/ha). When sweetpotato is intercropped in alternate row the yield was higher for both varieties (Resisto=6.10 t/ha, Jonathan=5.32 t/ha) than the when sweetpotato was planted with pigeon pea in the same row (Resisto=3.73 t/ha,

Jonathan=3.41 t/ha). Pigeon peas were not statistically different in terms of yield when planted as monocrop or as intercrop (p=0.098, alpha = 0.05). However when intercropped with sweetpotato in alternated row the yield of pigeon peas was higher. In general there was an increase in the yield of sweetpotato when intercropped with pigeon peas.

Key words: sweetpotato, intercrop, monocrop& alternate row

TH3ABS240

Displacement of the US-1 clonal lineage of *Phytophthora infestans* from potato in Kenya and Uganda

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Abstract

Until the 1990's, in most parts of the world collections of *Phytophthora infestans,* the causal agent of potato late blight, consisted of one clonal lineage known as US-1. However in most parts of the world, this lineage has been displaced by new lineages, which are generally considered more difficult to manage. Similarly, collections made in the last 2 decades in much of sub-Saharan Africa (SSA), as well as one made in 2007 in South Africa, Mozambique, Malawi, Tanzania, Burundi, Rwanda, Uganda, and Kenya consisted primarily of the US-1 clonal lineage. However, in the 2007 collection, a previously unidentified lineage, designated KE-1, was also found in two fields in Kenya. This then led to the question of whether US-1 was also being displaced in SSA. We analyzed of 260 samples from Kenya and 166 samples from Uganda collected in 2011 and 2012 using mtDNA haplotype and microsatellite markers. The results indicate that the US-1 clonal lineage can no longer be found on potato in Kenya; thus, there has been complete displacement of US-1 by newer genotypes of the KE-1 lineage. In Uganda, isolates from the eastern part of the country were also all KE-1, but in western Uganda, most isolates were still US-1, indicating a westward migration of KE-1 from Kenya through Uganda, and at a very fast pace. On tomato the situation is somewhat different as US-1 appears to be maintaining its dominance, although more sampling is needed for confirmation. Based on this rapid displacement, we conclude that the new KE-1 lineage of *Phytophthora infestans* is more fit than the older US-1 clonal lineage. Furthermore, simulation of late blight epidemics using the model LB2004 indicated that KE-1 will cause increased difficulties in controlling potato late blight in this region.

TH3ABS006

Promotion of community based potato seed tuber production for sustainable development of the commodity in north western parts of Ethiopia

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Ethiopia

Abstract

Potato is among the leading vegetable crops in Ethiopia and it covered about 0.164 million hectares of land during 2001. More than 940,209 tones were harvested.The crop directly supported on average more than 2,310,035 households. The Amhara National Regional State (ANRS) covers 43.45% of the total potato production and accounts for 36.09% of tubers produced in Ethiopia. Although the scale varies, potato is grown in almost all areas of the Region. Yet S. Gonder, Awi, N. Gonder, E. Gojjam and W. Gojjam surpass other zones. However, potato production is constrained by lack of improved crop varieties, post harvest management technology, absence of formal seed multiplying and delivery system As a result, the average productivity of the crop is limited to only 4.77 to 5.72 t/ha which is very low compared to world average productivity of 15 t/ha. Almost all farmers in the ANRS cultivate potato using local varieties and traditional management practices. To improve this situation the Research System has made efforts and finally developed high yielding varieties and their associated management practices. Following these findings the Research Extension division of the center demonstrated the improved varities Tolcha and Zengena in Yilaman Densa, Farta, Lay Gayint, Simada, Chelga, Fageta Lacoma, Ankesha, and Banja Sekudad district from 1997-2003/4 cropping seasons with the objective of creating awareness and demand of the new technologies by farmers, extension agents and other users. Field days were also carried at all districts during harvesting. As a result farmers have got the chance to assess the improved variety and package against their own traditional practices. Finally participant farmers recognized the superiority of the improved varities over their local variety in their maturity days (90-120), tuber yielding and resistance to the destructive potato late blight disease. Partial budget analysis showed that famers could get an additional benefit of 102.73-415.09 birr/ha by growing the improved varieties Tolcha and Zengena with its full production package. This paper presents these results.

TH3ABS019

IBRootNet: A collaborative platform for distributed sweetpotato root architecture phenotyping for enhanced crop improvement and management

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Abstract

In model systems, e.g., *Arabidopsis thaliana, Zea mays*, and *Oryza sativa*, significant progress has been made in root system architecture (RSA) research. It has been clearly demonstrated in these model systems that the understanding of the internal and external

variables that influence RSA has led to the advancement of fundamental knowledge and the development of practical applications such as varieties with enhanced tolerance to drought and nutrient deficiency. In sweetpotato, the understanding of the internal and external variables that influence RSA may be even more important because the storage roots are derived from adventitious roots that arise during the establishment of the plant. There is an emerging interest in understanding the role of adventitious root architecture in storage root formation and how this knowledge can be harnessed for enhancing crop improvement and management strategies. However, the current capacity for sweetpotato RSA analysis is hampered due to the lack of expertise and equipment in many locations where sweetpotato research and development is ongoing. IbRootNet is an informal collaboration among researchers at the Sweetpotato Support Platforms (SSPs) in Ghana and Mozambique, and LSU AgCenter's Sweetpotato Research Station and Department of Plant Pathology and Crop Physiology. The purpose of this collaboration is to develop and validate tools and methodologies for characterizing and describing genotypic variation in sweetpotato RSA, and to identify RSA variability in response to biotic and abiotic factors including but not limited to virus, nutrient deficiency and drought. Advances in RSA research in other crops are briefly reviewed and related to the state of the art knowledge of RSA in sweetpotato. Capacity of the WinRhizo root scanning and analysis system at the West African SSP is discussed and its use for analysis of root images from experiments conducted at remote locations demonstrated. Next steps in development of the IbRootNet platform are suggested in order to allow us to rapidly deepen our shared understanding of the "hidden half" of the sweetpotato crop.

TH3ABS041

Genomic characterization of sweetpotato viruses using next generation sequencing

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Abstract
Sweetpotato production decline due to viral diseases in South Africa is affecting value market chains, farmer livelihoods and nutrition negatively. This study undertook a survey of sweetpotato viruses in selected South African provinces and performed genomic analysis of all viruses infecting sweetpotato in the selected regions. A metagenomic approach was used to identify and characterize viruses causing sweetpotato disease symptoms observed during the survey. Double stranded viral RNA (dsRNA) was isolated from fresh leaf material using the cellulose extraction protocol. Sequencing was performed on the Illumina Hi-Scan SQ (Illumina Inc., San Diego, CA, USA) and sequence analysis done using CLC Genomics Workbench (CLC Bio). Further characterisation of sweetpotato virus 2 (SPV2) and sweetpotato chlorotic stunt virus (SPCSV) was done using molecular techniques. These two viruses have the potential to interact synergistically with other sweetpotato viruses like sweetpotato feathery mottle virus (SPFMV), to cause severe symptoms and up to 100%

yield losses. Results obtained from this study will contribute towards the development of better screening and diagnostic tools that will be of use to breeders, germplasm maintenance facilities, farmers and commercial producers.

Keywords*:* viral metagenomics, next generation sequencing, Illumina HiScan SQ, molecular characterization, sweetpotato virus disease (SPVD), sweetpotato virus 2 (SPV2) and sweetpotato chlorotic stunt virus (SPCSV)

TH3ABS043

Development of dual purpose potato varieties for the warmer climates of southern Africa

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Abstract
The development of well adapted, dual purpose potato varieties is increasingly important for the future growth of the potato processing industries in South Africa and its neighbouring countries. The present study was conducted at two locations in South Africa with the aim to select well adapted, high yielding potato clones with superior table characteristics and good processing qualities for the warmer climatic regions of Southern Africa. The early generations were evaluated at the ARC-VOPI (25°35'S: 28°21'E; Alt. 1164m) and the later generations at both the ARC-VOPI and Cedara Research Station (29°32'S: 30°17'E; Alt. 1076m) during spring of 2011 and autumn of 2012 in a randomised complete block design with three replicates. Potato clones with the desired tuber characteristics were selected from seed multiplication plantings for the replicated field trials at the two locations. In the first generation field planting, two seedling tubers of each clone were planted and both positive and negative selections for plant and tuber characteristics were applied. In the second generation, fifteen plants per clone were planted and positive selection was applied against tuber malformation and tuber secondary growth, while negative selection was applied for tuber yield per plant, tuber size and general appearance. In the third and fourth generation field plantings, respectively 90 and 360 plants per clone were established, and negative selection was applied for general tuber appearance, tuber yield per plant, average tuber mass and number of tubers per plant. From the fifth to seventh generation, potato clones were evaluated at two locations. At Roodeplaat seven clones from the seventh generation field planting were identified with high yields, superior table characteristics and good processing qualities (e.g. specific gravity and chip colour), while at Cedara six clones with suitable characteristics were selected. The best clones based on table as well as processing qualities were selected to be used as parents in the breeding of dual-purpose potato varieties. Three clones from the seventh generation group at both locations may be recommended to be released as new dual purpose potato varieties in South Africa.

Keywords: Clones, generation, potato

TH3ABS048

Trend of virus infection on sweetpotato varieties for highland production in central Rift Valley of Kenya

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Abstract
In Kenya sweetpotato virus disease (SPVD), a synergistic interaction of *Sweetpotato chlorotic stunt virus* (SPCSV) and *Sweetpotato feathery mottle virus (*SPFMV); *Sweetpotato mild mottle virus* (SPMMV); and C*ucumber mosaic virus* (CMV) have contributed to cultivar quality decline and low yields due to vegetative perpetuation of virus infected material. Hence screening for resistance to SPVD is a feasible strategy that can sustain sweetpotato production. The objective of the study was to determine the trend of disease incidence, severity, virus species and their effect on root yields of sweetpotato varieties for highland production. Fourteen varieties were screened for resistance to SPVD at KARI-Njoro (LH3-2166m a.s.l.) for a period of six months. A complete randomized block design experiment replicated three times was established. Disease incidence, severity, virus species; their mode of infection; and their effect on yields were assessed using standard operating procedures. Visual observation and NCM-ELISA were done on 42 samples for SPFMV, SPCSV, SPMMV and CMV. Observed virus disease scores were recorded monthly from June to November 2011 using a score of 1-9. Identification of the virus species was done using NCM-ELISA in the laboratory. Results showed variation in severity of infection among cultivars (score of 4 – 6). Infection was higher and more severe when rainfall was higher but less with lower moisture levels. The moisture level most likely provided the vectors with a constant supply of food. The cycle of infection showed an efficient mechanism for the perpetuation and dissemination of SPVD. The cycle also showed that fourth month is possible time to get fairly clean material for propagation but thereafter there is a build-up of virus diseases. Laboratory results of NCM-ELISA showed that SPFMV had the most incidence of 69%; CMV 60%; SPMMV 55%; SPCSV 33%. Effect on root yields varied with varieties; new varieties (KNSP013, KNSP06/1(2), KNSP010/6(1) and KNSP02/16(1) performed better than the current varieties. Results confirmed that high virus infection reduced yields significantly but some new varieties still yielded high an indication of tolerance. Moisture levels and harvest time of planting material have an effect on incidence and severity. Knowledge on the trend of infection will enable effective control of sweetpotato viruses.

Keywords: SPVD, Trend, sweetpotato

TH3ABS067

Evaluation of field resistance stability of potato cultivars to late blight

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Abstract
Potato late blight caused by *Phytophthora infestans* Mont. De Bary has induced significant yield losses in the past and is still a major threat to potato production in developing countries. Chemical control is expensive, short durational and has health hazards while biological control is in its infancy for this disease. The most effective and environmental friendly way to prevent widespread devastation by late blight is to incorporate natural resistance in potato cultivars. The aim of this research was to determine the field resistance stability of potato cultivars to late blight. Late blight resistance of 13 potato genotypes was studied at Kabete in 2010 long rain and 2011 long rain cropping seasons. Planting was done in 3m x 3m plots with four rows and 10 tubers per row. Cultivars were replicated three times in a randomized complete block design. Foliar late blight resistance was assessed on the basis of relative area under disease progress curve (RAUDPC) and ratings were used to classify the cultivars into late blight resistance groupings. Significant differences were observed among the cultivars in both seasons on their resistance levels to late blight. Cultivars Kenya Karibu, Kenya Mpya, Kihoro and Kenya Sifa had significantly higher resistance to foliar late blight. The most susceptible cultivars were Arka and Desiree. There was a significant seasonal effect on the disease with high disease pressure in 2010 long rain than 2011 long rain season. The resistance levels of these genotypes can be exploited directly in production or indirectly in conventional breeding to improve potato genotypes at desirable level.

Key words: Resistance, Late blight, RAUDPC, Cultivars

TH3ABS068

Integrating varietal resistance and phosphonate fungicide in management of foliar late blight in potato

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Abstract
Late blight caused by *Phytopthora infestans* is still a limiting factor to potato production in spite of the amount of knowledge available. Chemical control is becoming more difficult due to the appearance of new and more aggressive *P. infestans* populations and high costs of

fungicides in developing countries. Trials were conducted to evaluate the efficacy of Phosphonate fungicides, the potential of combination with resistant potato cultivars and economic impact as late blight control alternative. Two Phosphonate formulations; Agrifos 400 and Fosphite were compared with Ridomil alternated with Mancozeb on different potato varieties in Kabete, Koibatek, Njambini and Limuru. Planting was done in 3m by 3m plots with four row and 10 tubers per row. Experimental units were replicated three times in a split plot design.The results showed an effect of Phosphonates, which represent lower risks to human health and environment than conventional fungicides, on control of foliar late blight. In all the sites of the trial, Agrifos 400 was not significantly different with Ridomil alternated with Mancozeb in control of foliar late blight on most of the varieties used and they were also comparable in yields with no significant differences. Agrifos 400 is shown as a good alternative for late blight control, having similar yields at a lower cost compared to conventional fungicides. The study suggests that the relatively inexpensive Phosphonate fungicides have significant potential to become an effective management tool for control of foliar late blight, and can be used as an alternative to the hazardous conventional fungicides. Given the potential economic, health and environmental benefits to be gained by using available Phosphonate compounds, farmers in developing countries should be encouraged to include Phosphonates in their late blight management strategies.

Key words: Resistance, Late blight, RAUDPC, Cultivars

TH3ABS086

Evaluation of elite potato clones for drought tolerance in western Uganda

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Abstract
Potato, *Solanum tuberosum* plays a major role in national income, food and nutritional security. Potato production is being affected by fluctuation in precipitations in both timing and amount, increased temperatures, which together reduce productivity. In potato, water deficit leads to reduced growth, yield and tuber quality. This study identified potato clones resilient to water and heat stress and determined the effect of temperatures on the performance of the selected clones. A set of twelve potato clones was evaluated both on station and on farm for two seasons in Kabale, Mbarara and Kasese districts. Farmer participatory approach was employed on farm. Highly significant differences were observed among clones selected by farmers in Mwizi ($p<0.001$). Yield data from all the trials revealed high significant differences at ($p<0.001$) in clone performance. The average yield at Kalegyere was 16 t/ha and seven clones yielded above average with 395111.13 giving the highest mean yields for all the on station sites of 22t/ha, 10t/ha and 7t/ha for Kalegyere, MBAZARDI and Mubuku respectively. From the on farm sites, Mwogyera gave the highest yield of 31t/ha, Isule 6.6t/ha and Mwizi 4.7t/ha. Clones showed significant differences in number of flowered plants, number of flowers, number of leaves, number of stems, leaflets length, leaflets width and leaf area ($P<0.01$). Significant interactions were only observed for plant height, number of stems and number of leaves at ($P<0.01$, 0.001 and 0.05) respectively. Maximum plant height was recorded for 393382.44 (59.3cm) and least for 381381.20 (40.3cm). 395111.13 added more leaves (4), 393382.44 had more flowered plants (26), 396034.103 more flowers (21),

395029.250 more leaves (14), 396034.103 and 391691.96 more stem (4) while 395111.13 and 395029.250 had a bigger leaf area (11.8) compared to other clones.

Key words: Potato, growth parameters, stress, tolerance, clones

TH3ABS093

Application of soil amendment can promote root growth, nutrient uptake, and tuber yield of potato

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Abstract
The intensification of potato production in recent years has caused the degradation of soil health and soil productivity in potato growing regions. To maintain or increase tuber yield, the use of chemical fertilizers has increased in potato production systems. The potato crop has a poor root system and is not very efficient in nutrient uptake, therefore allowing most of the fertilizers applied to be leached into ground waters. Field studies were conducted at the San Luis Valley Research Center, Colorado State University, USA, to evaluate the ability of 'nutrisorb' (a soil amendment) to increase root growth, plant nutrient uptake, and potato tuber yield and quality. Experimental treatments included the application of two rates of 'nutrisorb' (10.5 and 21 L/ha), and a control where no 'nutrisorb' was applied. 'Nutrisorb' application increased root mass development by 68%. Macro and micro nutrient uptake was increased significantly when 'nutrisorb' was applied. Plants that received 'nutrisorb' application showed early tuber bulking as well as increased tuber bulking due to higher harvest index. Total and marketable (>4 oz., >6 oz., >10 oz.) tuber yield increased by 16%, 24%, 30%, and 59%, respectively, when 'nutrisorb' was applied. Tuber external defects (growth cracks, knobs, and misshapes) were significantly reduced when 'nutrisorb' was applied. Economic analysis done on these studies indicated that farmers will make more profit by using 'nutrisorb' as a soil amendment in their potato production system. Data from these studies demonstrate that sustainable potato production can be achieved with the use of soil amendment such as 'nutrisorb'.

TH3ABS097

What the major factors contributing to the huge potato yield gap in SSA-results from a study in Kenya

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Abstract:
Current average potato yields in Sub Saharan Africa are very low at 7.8t/ha (FAOSTAT, 2012) compared to a potential of at least 25t/ha. This yield gap can be attributed to the use of low quality seed potatoes, low yielding varieties, poor disease and inadequate soil fertility management. To obtain better data on the yield gap causes a field-study has been conducted in major potato production regions of Kenya considering farm and rotation systems, potato seed sources and varieties, soil fertility status, fertilizer use, disease incidence and farmers management practices from 150 farmers. The study has been conducted in during long and short rain seasons of 2012 at flowering stage of the crop in order to collect most reliable results on the different parameters.
Results
Farming systems: Potato farmers have small farms with 0.6-2 ha in mixed farming systems all have livestock.
Plant nutrient status: Most of the potato crops tested were below the optimal N,P,K levels. Especially, N and P were the most limiting nutrients. However, about 65% of the samples were below optimal K levels and 20% were below half of the recommended status.
Fertilizer regime: About 90% of the farmers used mineral fertilizers mainly DAP, about 25% applying farm yard manure. On average farmers applied about 30kg N/ha, which is only about 33% of the recommended rate.
Potato Diseases: 67.5% of fields showed Bacterial Wilt symptoms (average 20% wilting plants); Late Blight severity was 26% foliage loss; severe (15%) and mild virus infections (24%). Considering the early growing stage high yield losses due to those diseases could be expected.
Seed quality: 89% of the seed was of poor quality; 8% used positive selected seed and certified seed was used by less than 2% due its accessibility, price and transport constraints. The poor seed quality used by farmers is likely to be the reasons for the high indices of BW and viruses.
There was a clear ***lack of farmers' knowledge*** as e.g. the majority of the farmers did not recognize the disease symptoms, misunderstood positive selection as they only removed the foliage but not the tubers, used wrong spraying regimes to control LB, sprayed against viruses instead of controlling the vectors. The results on the study basically confirming, the major production constraint's reported in the literature. However, at all parameters a huge deviation could be found, reflecting the diversity of biological, educational, social and economic differences in the region.

Keywords: Potato, yield gap, Kenya

TH3ABS101

Performance of Sweetpotato Clones Developed for Highland Production in Central and South Rift, Kenya

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Abstract
Sweetpotato (*Ipomoea batatas* (L) Lam) is among the most important staple food crops in the East and Central Africa region where it is strategic for ensuring food security in drought situations. In Central and Western regions of Kenya, sweetpotato is highly regarded as a food security crop when local staple crops fail and during the dry season when other foods are scarce. Low yields and yield instability due to the use of old land races and lack of

adaptable varieties are limiting sweetpotato production in most of these regions. The aim of this study was to evaluate advanced/pre-released sweetpotato clones using participatory varietal evaluation (PVS), to determine their adaptability and acceptability in medium to high altitude production areas. Advanced sweetpotato lines and varieties were tested in multi-location trials, maintained collaboratively by resource-constraint farmers, agricultural extension officers and research scientists at five sites (Njoro, Lanet, Ravine, Kabianga and Marigat) during 2009/2011. The evaluation included ten experimental sweetpotato test clones and four commercial cultivars over a period of two years at five locations in Central and South Rift of Kenya to study their performance in high altitude areas. At all the sites, ten selections were planted using RCB design replicated three times. The plot sizes measured 4 m x 2.4 m, and the spacing used was 100 cm x 30 cm. The vines were planted on ridges and all other agronomic practices associated with optimum sweetpotato production such as weeding, were applied uniformly to all the plots. The plots were kept weed free throughout the trial. From the third month, notes were taken on plant vigour (on a scale of 1 – 5 where 1 refers to no growth and 5 is vigorous growth). Harvesting was done through farmer participatory process and the following notes were taken: shoot weight, total number of tubers per plant, weight of tubers per plant, number and weight of marketable tubers per plant and yields per hectare. There was significant ($p \leq 0.05$) difference in the number and weight of the marketable tubers obtained across the five sites with some clones yielding more at some sites compared to other sites, with most of the test clones performing better than the mean of the checks. Though most of the clones evaluated are specifically good for highland production, with good yields (over 15 t/ha) and high dry matter five clones were selected based on stability across sites and acceptability.

Keywords: *Sweetpotato, yield, medium to high altitude, general acceptability*
TH3ABS106

In vitro evaluation of orange-fleshed sweetpotato for drought tolerance using polyethylene glycol

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Abstract
In vitro techniques have been shown to be useful in identifying relatively salt tolerant genotypes at early stages of development. In this study, drought induced alterations in early shoot and root development of 59 sweetpotato genotypes was evaluated in the tissue culture laboratory at the Kenya Plant Health Inspectorate Services, Quarantine station, Muguga, Kenya. These genotypes were obtained from Lima, Peru and were evaluated against two Kenyan checks Marooko (drought tolerant) and K566632 (drought susceptible). These were assessed with polyethylene glycol (PEG 6000MW) at three different concentration levels 0, 10 and 15 g/l. The experiment was laid out in a factorial complete randomized design with three replications. Data on shoot and root growth was recorded during tissue regeneration. Analysis of variance indicated genotypes, salt levels and salt level x genotype interaction, were highly significant ($p<0.01$) with respect to all the traits. At 15 g/l concentration of PEG, genotypes 189135.9, 194515.5, 440024, 441724 and 440001 had roots that were longer than those of Marooko. This level of stress severely affected the production of biomass in most of the genotypes. Genotypes 194515.5, 194539.3, 441724, 441538 (dark orange-fleshed) 189135.9, 401055, 441097 (orange-fleshed), 441768 (light-orange fleshed) 192033.5 (yellow-fleshed), 440429 (light-cream) recorded high leaf expansion, higher stem length elongation, higher root and shoot growth and high dry matter production at all salt levels indicating their ability to withstand severe water stress conditions.

Genotypes 189151.38, 420027, 440132, 440104 (dark orange-fleshed) 440034, 421111 (Light-orange fleshed), 440166 and 441755 (yellow-fleshed) were identified as susceptible. The technique was found to be a useful tool for screening large number of breeding lines of sweetpotato genotypes for drought tolerance within a relatively short time

TH3ABS114

Can mineral oil protect potato seeds against aphid transmission of PVY?

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Abstract
The spread of PVY in Tunisia every year is a limiting factor for the certified seed production. PVY^{NTN} is the most important reason for downgrading seed potato lots of Spunta to lower classes and rejection of certification. Transmission efficiencies of aphid species for different PVY strains are established for the most abundant ones. Totally about 15 aphid species are known to be vectors of PVY with different efficiency. Five aphid species colonising potatoes: *Aphis gossypii, Macrosiphum euphorbiae, Myzus persicae, Aphis fabae* and *Aulacorthum solani*. Eleven other non colonizing potatoes aphid species seem to be far more important in PVY transmission: *Aploneura lentisci, Brachycaudus helichrysi, B. cardui, Hyalopterus pruni, Hyperomyzus lactucae, Acyrthosiphon pisum, Rhopalosiphum padi, R. maidis, Aphis spiraecola, Cavariella aegopodii* and *Lipaphis erysimi*. Therefore, to limit PVY propagation, insecticides sprays are used to control aphids. Intense use of aphicides has led to the selection of resistant aphid populations. In PVY control, few alternatives are available for use in potato seeds production, among them mineral oil spray can reduce dissemination of PVY and many reports have demonstrated the efficiency of these oils. Nevertheless, the use of mineral oils for agricultural aphid management is still very limited in Tunisia, probably due to tendency of the seed producers to think that is the cause of 1) phytotoxicity while this is a problem only when used with fungicides and 2) the loss of yield. Conscious of this problem, we are following a strategy consisting in developing oil control taking into account the effect on aphid multiplication and plant protection against aphids. Conceivable strategies are presented and developed in this paper to evaluate the effect of the mineral oil with and without insecticides as a treatment to limit PVY infection. We showed that infectious aphids can't transmit PVY in a treated plant with oil in the laboratory. Healthy aphid can't acquire viruses on oil treated plants infected by PVY. Oil treatments of infected plant limit PVY propagation at 2.5% while none treated plants with oil show a level of 9.5% infection. Finally there is no significant yield losses in treated potato field with oil (varying from 0.28 to 0.33 kg/plant) compared to non-treated field (0.26 to 0.30 kg). This work confirms that farmers have a bias of oil control unfounded.

TH3ABS117

Genetically modified potatoes in global markets

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Abstract
Genetically modified (GM) crop plantings are expanding all over the globe. Three African countries – Egypt, South Africa and Burkino Faso – have approved GM crops, but not GM potatoes. This paper discusses findings from three survey-based research projects: (1) economics of insect-resistant GM potatoes in Africa, (2) GM attitudes among attendees of 15 agricultural biotechnology short courses for developing countries and (3) North American attitudes regarding red GM (transgenic) and green GM (intragenic) technology. Results show potential positive economic impacts for GM potatoes on both large and small farms in Egypt and South Africa. Attendees of the agricultural biotechnology course indicate that anti-GM forces may be losing power in developing countries. Green GM potatoes are seen by many as more likely to be accepted by consumers than Red GM potatoes. In spite of past GM-potato market problems in North America, Europe and Africa, scientists continue to develop GM potatoes using both red and green technology. Future acceptance of GM potatoes will depend on developing consumer-friendly attributes and addressing concerns of NGOs that have been anti-GM. Identity preservation (IP) schemes for the potato marketing chain will be important to prevent admixture of GM potatoes with conventional potatoes.

TH3ABS121

Assessment of plant extracts for management of late blight caused by *Phytophthora infestans*

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Abstract
Late blight caused by *Phytophthora infestans* is the most important disease of potato and tomato in tropical highland agro-ecologies. Experiments were conducted during 2004 and 2005 to assess the fungitoxicity of methylene chloride/methanol leaf extracts of *Ageratum houstonianum, Eucalyptus saligna, Garcinias meathmannii* and *Tephrosia vogelii* on *P. infestans* development. The extracts (3 %) were evaluated for sporangial germination inhibition, latent and incubation periods, lesion size and late blight severity on tomato plants. Inoculated leaflets and plants were incubated in the greenhouse at 20°C, 12 h photoperiod for 7 days. Sporangial germination was significantly inhibited (68%) by Tephrosia extract while late blight lesion size was highly limited by Ageratum and Tephrosia extracts (91-100 %). Except for Garcinia extract, all the extracts significantly extended incubation period and reduced late blight severity. The fungitoxic effects of Ageratum and Tephrosia extracts were

comparable to synthetic fungicides, Ridomil Plus (12% metalaxyl + 60% cuprous oxide) and maneb, used as positive controls, indicating their potential as components of an integrated pathogen management program for tomato late blight.

Keywords: Fungitoxicity, late blight, *Phytophthora infestans*, plant extracts, tomato

TH3ABS122

Evaluation of introduced populations for sweetpotato virus disease and alternaria stem blight resistance

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Abstract
Sweetpotato is an important source of calories and pro-vitamin A in the developing world. However, the crop suffers major diseases resulting in significant yield losses. Field screening of sweetpotato germplasm for resistance to major diseases, namely, sweetpotato virus disease (SPVD) and Alternaria stem blight has commonly been based on symptom severity and incidence of plants infected with the diseases following natural infection. In this study, new sources of SPVD resistance (breeding populations) from the International Potato Center (CIP), Lima, Peru, were evaluated in the field at Namulonge in Uganda under high SPVD pressure and moderate Alternaria blight pressure. The objective was to identify SPVD resistant genotypes for use as parents in sweetpotato population improvement at Namulonge for the East and Central Africa sub-region. A total of 1,410 genotypes were evaluated for SPVD and Alternaria blight in replicated field trials for four seasons, during 2010 to 2012. Based on field symptoms, virus titer accumulation in 12 promising genotypes was assayed using quantitative reverse transcription polymerase chain reaction (qRT-PCR). Except clones 17.3 and 24.7 which can be used as parental sources for SPVD and Alternaria blight resistance, all the evaluated introduced clones can be eliminated on the basis of field symptom expression, and high virus titer accumulation.

TH3ABS135

Near Infrared Reflectance Spectroscopy: Accelerating sweetpotato breeding programme in Ghana.

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Abstract
Ghana is among few countries that can boast of the state of art equipment for screening large number of breeding materials in a very fast, and less expensive fashion. With the introduction of the Near Infrared Reflectance Spectroscopy (NIRS) through the SASHA project, quality attributes of food crops can be easily and timely analysed. The traditional method for determining quality traits of food crops are too laborious, expensive, complex, and time consuming when screening many samples in a breeding programme. About 3,000 dried samples of sweetpotato roots were scanned within the last quarter of 2011 and 2012 breeding seasons with the aid of the NIRS. Within few seconds, the starch, protein, zinc, iron and beta carotene contents of the sweetpotato materials were determined. In addition, the key endogenous sugars that contribute to sweetness of the roots; fructose, glucose, and sucrose, were measured. The NIRS will indeed facilitate breeding and screening of large germplasm for new improved planting materials, thereby boosting the agricultural sector and the economy at large.

Keywords: screening, scanning, breeding, traits

TH3ABS138

Advances in a breeding information platform for potato and sweetpotato

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Abstract
Potato and sweetpotato breeding involves not only handling large amounts of plant materials, locations and respective environmental and management conditions but also the associated phenotypic traits like yield, resistance levels and nutritional values. Molecular markers have been introduced to facilitate the selection process – this current portfolio of breeding information already poses challenges for an effective information platform. However, already new high-throughput phenotyping and genotyping technologies are on the horizon providing magnitudes more information. Also, other advances in breeding methods and information and knowledge management have become apparent adding additional requirements. In short, a current breeding information platform will need to address the following principal challenges: a) raw data from the latest high-throughput phenotyping and

genotyping platforms are typically already too big for standard laptops or standard PCs; b) new breeding methods like genome wide selection have the promise of integrating information from a diverse set of sources given a common repository to predict breeding values; c) following best practices to share those data with the wider scientific community as soon as possible. Here, we outline a new architecture for a breeding information platform to address these challenges based on review of currently available standards and open source software tools. Principal components of the proposed platform are a standardized set of traits (ontologies), a cloud based data repository, a near-real time information discovery tool, an online/offline data analysis and visualization platform, and supporting tools for data auditing and knowledge management.

TH3ABS139

The sweetpotato composite genotype set: an update on a genomic resource

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Abstract
Sweetpotato is one of the major food crops worldwide and of rapidly increasing importance in Africa. The demand for new varieties is increasing and also needs to respond to new pressures from climate change. However, sweetpotato breeding is complex and time consuming using traditional phenotypic evaluations only. Genomic resources for breeding in sweetpotato would greatly advance progress but such resources are still very few. Under the Generation Challenge Program the concept of the 'composite genotype set' was developed and applied to several crops a few years ago. The International Potato Center (CIP) with funds from the Generation Challenge Program started to define and select such a subset of genetic materials from CIPs genebank to be characterized both by phenotypic traits and molecular markers. The set was selected to include representative landraces from across the world, some breeding lines and closely related wild species. A first set included about 472 materials; after field and molecular characterization the current set includes 390 accessions. Field data were obtained for two years and two locations. It was characterized using the FAO/IPGRI/CIP standard descriptors of morphology, standardized fotos according to a CIP protocol, a set of 90 SSR markers as well as by seven combinations of AFLP markers. In addition, evaluation data for several nutrients (protein, starch, beta-carotene and minerals like magnesium, iron and zinc) are available along with data for dry matter and frying quality. This catalog of the sweetpotato composite genotype set may serve for further analyses and as a starting point for genome wide selection.

TH3ABS141

Potassium fertilizer source and application rate do influence potato tuber yield and quality

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Abstract
The potassium (K) fertilizer program used by potato growers can influence the crop in several ways. Insufficient K can result in reduced tuber yield and smaller sized tubers. Potassium source differences have also been expressed through delays in tuber development and reduced tuber specific gravity. Information on source and application rate of potassium fertilizer is needed for all potato growing regions. Studies were conducted at the San Luis Valley Research Center, Colorado State University, USA, to evaluate the effect of potassium fertilizer source and application rate on potato tuber yield, tuber size distribution and quality. The study was designed to evaluate the response of potato to four rates of K_2O (0, 40, 80, or 120 lb K_2O/acre) when applied as either muriate of potash (MOP) – KCl, with or without the addition of sulfur (S) fertilizer, or as sulfate of potash (SOP) – K_2SO_4. A control treatment was included where no K fertilizer was applied. Potassium fertilizer source and rate of application significantly influenced tuber yield and tuber size distribution when SOP was compared to MOP with no S fertilizer (MOP-S) or MOP with S fertilizer added (MOP+S). At the low application rate of 40 lb K_2O/acre, SOP increased marketable (> 4 oz) tuber yield by 14% when compared to MOP+S. For large marketable size (> 6 oz) tubers, SOP increased yields by 18% and 20%, when compared to MOP-S and MOP+S, respectively. At 40 lb K_2O/acre, SOP increased the yield of premium size (> 10 oz) tubers by 91% and 110% when compared to MOP-S and MOP+S, respectively. The use of SOP as source of K fertilizer reduced tuber external defects and increased tuber specific gravity. Data from this study indicate that the use of sulfate of potash as source of K fertilizer at a relatively low rate of 40 lb K_2O/acre increased marketable and premium size tuber yield, and improved tuber quality.

TH3ABS168

ILCYM - A Generic platform for developing insect phenology models and conducting population analysis and mapping

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Abstract
ILCYM is an open-source computer-aided tool built on R and Java codes and linked to uDig platform, which is a basic geographic information system (GIS). The software package consists of three modules the "model builder", the “validation and simulation”, and the “potential population distribution and risk mapping”. ILCYM’s model builder contains a library of several empirical linear and nonlinear models, including the derivations of the biophysical models, which have been proposed to define critical temperatures of insects’ development. Several statistical measures are incorporated for parameters estimation and models comparison. Under validation and simulation module is demonstrated how phenology models are applied for estimating insect population abundance with constant and fluctuating

temperatures. Outputs of the simulations are life table parameters that include: net reproduction rate, mean generation time, intrinsic rate of increase, finite rate of increase and the doubling time. Through these analyses, the biology and temperature requirements of insects can be defined, as well as the effects of different diets or host plants on insects' life table parameters. ILCYM also supports investigation between natural enemies (e.g., parasitoids) interactions and its target pests as well as the natural enemy potential control efficiency in integrated pest management system. Further, possible outbreaks of pest populations in relation to changes in temperature can be simulated. The last ILCYM's module estimates three indices (the establishment risk index (EI), the generation index (GI) and the activity index (AI)) that guide in assessing the potential population distribution and abundance of a particular species. Several functionalities for vector (dbf to shape, raster to points, raster to polygons, extract by points, etc.) and raster analysis (merge, cut, mask, aggregate/disaggregate, re-class, describe, raster calculator, etc.) are part of the ILCYM-GIS component. Such tools improve the manipulation of large datasets and help ILCYM's users in analyzing and visualizing the risk assessment maps. Additionally, a sub-module (index interpolator) for analyzing the index at higher spatial (pixel size of 90m) and temporal resolution (daily data) for capturing small-scale of insect population distribution and abundance is also included into ILCYM.

TH3ABS169

Integrative breeding strategy for making climate smart potato varieties for sub-saharan Africa

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Abstract

Breeding of crop is becoming increasingly complicated because of the increasing number of requirements for new varieties. Adapting potato to climate variability is among the requirements for new varieties where its production in Africa is subject to much climate variations. Rainfall is successively becoming more erratic with longer and hotter dry spells and more intense rainstorms, impacting food security negatively in many African farming systems. Tolerance to climate variability, as a trait to contribute to food security of many smallholder farmers in harsh environments, must be expressed in terms of increased yield under field conditions and combined with traits that correspond with the preferences and needs of farmers and market. But, those traits related with tolerance to climate variability (mostly drought and heat) are genetically and physiologically complex traits for which plants have developed a range of strategies to balance the need for growth and reproduction on one hand and tolerance to adverse conditions on the other hand. Moreover, these traits in crops mostly interact with other stress factors, like low soil fertility, soil acidity, salinity, insects and pathogens under farmer conditions. Bringing together right genes to overcome constraints of climate variability in a potato crop together with enhanced level other desirable traits like user preference, yield and resistance of biotic stresses definitely requires an integrated breeding strategy that uses the knowledge of scientists as well as farmers. A breeding strategy to confront diverse and dynamic preferences and complex mechanisms of tolerance should systematically synthesize and empirically combine contrasting parents to see what trait combination give a boost in yield under farmers' conditions. It should integrates participatory, physiology and genomics tools to breed new varieties of climate smart potato varieties that combine a range of mechanisms in farmers' and market preferred

types. Hence, knowledge of the local conditions, changes in agro-ecological and socio-economic conditions, and diversity caused by climate change and market dynamics together with the mechanism and allele discovery at plant level are crucial to develop a variety that meets the needs of farmers and the market. Only with an integrated understanding of these various aspects, can a breeding program develop a more climate smart potato genotype(s) for a range of farmer conditions, markets and preference.

TH3ABS210

Evaluation of dual purpose sweetpotato (*Ipomoea batatas* L *(lam.)* cultivars for roots and fodder yields in the Eastern Province of Rwanda

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Abstract
Crop residues and agro-industrial by products are becoming increasingly important ruminant feed resources because of increasing population pressure and fragmentation of land in Rwanda. Sweetpotato is among the food-feed crops whose potentials in household food; nutrition and income security has not been optimally exploited. Dual-purpose attributes differ among varieties of sweetpotato; and the expressions of the trait also differ with environmental conditions and management. The objective of the study was to determine the effect of cutting regimes on dry matter yield and nutritional characteristics of the roots and vines of selected sweetpotato cultivars. Six improved and two local checks were evaluated for root and vine biomass production and nutrient composition using Near Infrared Spectroscopy (NIRS). In this analysis, two vine cutting regimes (rationing at 80 days after planting and intact crop) in three agro-ecologically different districts in the Eastern Province of Rwanda were compared. Results showed that ratooning at 80 days after planting nearly doubled vine yield without affecting root yields ($P>0.05$). There were significant differences among cultivars in vine productivity ($P<0.01$). Also, nutrient composition in the vines differed by variety, location and cutting management. In roots, nutrient composition differed more by location than by variety. Five dual-purpose cultivars were identified. The study showed that food-feed crop such as sweetpotato can be effective protein supplements for use in feeding the lactating dairy cows in Rwanda. All the eight cultivars were dual purpose sweetpotato; especially when subjected to strategic ratooning regimes. Rapid multiplication distribution of vines of these cultivars is recommended**.** Harvesting two times at 80 intervals does not affect root yield but increases vine yields. Therefore it is the recommended, ratooning regime in sweetpotato root for food and vines for feed in Eastern Province of Rwanda.

Keywords: Sweetpotato, vine, root, yield, cutting management, nutrient composition

TH3ABS227

Organic potato production: prospects in Kenya

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Abstract
Organic farming has become an important practice in food crop production globally. The world experiences exponential population growth which puts pressure on the limited land resource to produce enough to feed the population. Due to an increasing population, there has also been pressure on land to create more room for settlements hence encroaching on productive land which should be utilized in food production leading to destruction of useful ecosystems. The limited land resource also has deteriorated due to over cropping to produce more food crops. Due to deteriorating soil fertility, yields have gradually nose dived necessitating quick interventions for restoring soil fertility for improving crop yields. This has led to use of higher rates of inorganic fertilizers and chemicals which are a quick fix to be able to increase yields per unit area. Continuous use of these inorganic inputs brought some setbacks which also have become an obstacle to improved crop productivity such as non renewal of soil carbon and soil organic matter, increase in soil acidity and destruction of soil structure because the inorganic inputs are basically synthetic, land degradation and loss of biodiversity. In Kenya organic food production is slowly gaining popularity as the populace starts getting concerned with the ways food products are produced due to health concerns and the deteriorating ecosystem. Organic inputs have been found to build soil structure, buffer soils, enhance cation exchange capacity and increase soil carbon and enhance ecosystem balance hence preserving the biodiverity. This has led to many organic fertilizer materials being adopted in food production such as legumes, compost manure, farmyard manure, green manure, rock phosphates, Yad bio-vitalizers®, Kelpak® and Earthlee®. Kelpak®, Earthlee® and Yad bio-vitalizers® have been used to grow potatoes in Kenya with positive results. Bio-vitalizers used increased the yields by 10% while Earthlee® and Kelpak® used increased the yields by 15%. This paper is a review of prospects of organic potato production in Kenya.

Key words: Soil carbon, deteriorating ecosystem, soil fertility, land, inorganic inputs

TH3ABS224

Aphids infesting potato in Kenya

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Abstract
Aphid-transmitted viruses probably cause greater economic loss in potato production than all other insect-related damage. Some 40 virus species are known to infect potato, and of these, 13 are aphid-transmitted. Monitoring of aphid populations in potato fields is therefore essential to determine areas with low aphid occurrence suitable for potato seed production and the right moments for haulm destruction. While plenty of information on such areas is available in traditional seed potato producing countries of America and Europe, there is none available for Kenya. The current study determined the best locations for seed potato multiplication in Kenya by monitoring aphids in major potato producing areas using two methods: yellow water traps and aphid-leaf counts. Ten aphid species, *Aphis gossypii* (Glover), *Aphis fabae* (Scopoli), *Aulacorthum solani* (Kaltenbach), *Acyrthosiphon pisum* (Koch), *Brevicoryne brassicae* L., *Cavariella aegopodii* (Scopoli), *Macrosiphum euphorbiae* (Thomas), *Myzus persicae* (Sulzer), *M. ascalonicus* (Doncaster), *Rhopalosiphum maidis* (Fitch) were caught in YWTs while four aphid species, *A. fabae*, *A. gossypii*, *M. persicae* and *M. euphorbiae* were also found colonising potato leaves in Kenya. The populations of the aphid species varied significantly, *R. maidis* had the greatest numbers, followed by *B. brassicae*, *A. gossypii*, *M. euphorbiae*, *M. persicae*, *A. fabae* in this order while *A. solani* was the least abundant. The populations of *A. fabae*, *A. solani*, *C. aegopodii* and *M. ascalonicus* did not vary between seasons and sites but *A. gossypii*, *A. pisum*, *B. brassicae*, *M. euphorbiae*, *M. persicae* and *R. maidis* populations varied significantly between the five sites, and between the three seasons. Njabini and Nairobi consistently had low aphid numbers and may be the sites most suitable for potato seed multiplication.

Key words: Aphids, viruses, Kenya, Potato seed production

TH3ABS180

Improve productivity of sweetpotato (*Ipomea batatas* L.) through productions of virus free mersitem cultures in Ethiopia

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Abstract
Sweetpotato (*Ipomoea batatas* (L.) Lam) is a staple, carbohydrate rich food crop in tropical Africa. However, its production is limited by several factors mainly virus infection. So far more than 20 viruses have been reported to infect sweetpotato; currently, four sweetpotato viruses: Sweetpotato feathery mottle virus (SPFMV), Sweetpotato mild mottle virus (SPMMV), Sweetpotato chlorotic stunt virus (SPCSV) and Sweetpotato chlorotic fleck virus (SPCFV) are widely distributed in Eastern Africa. In Ethiopia SPFMV and SPCSV are the most widely distributed which causes extensive yield losses .Due to its wide spread and virulence, they caused temporarily hold on distribution of sweetpotato nationally from Hawasa Agricultural Research Center; Ethiopia. This study was to develop an efficient *in vitro* protocol for the production of virus free planting materials. Meristems were excised from four sweetpotato varieties and cultured in Murashige and Skoog (1962) (MS) medium containing different concentrations of 6-Benzylaminopurine (BAP), α-Naphthalene Acetic Acid (NAA) and Gibberrelic acid (GA_3) for shoot initiation. The shoot tips and nodes were cultured on different concentration of BAP alone or in combination with kinetin for shoot multiplication. Best multiple shoots were obtained from MS medium containing 0.5 mg/l BAP with 0.5 mg/l kinetin. Cultured on MS medium without IBA (Indole Butyric Acid) were best in root proliferation. The plantlets were tested for ten sweetpotato viruses using Nitrocellulose membrane-Enzyme Linked Immunosorbent Assay (NCM-ELISA) and 99% were virus free.

Key words: Meristem, Murashige and Skoog, NCM-ELISA

TH3ABS191

Evaluation of potato varieties and clones to late blight (*Phytophtora infestans*) in Vakinankaratra area

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Abstract
The potato (*Solanum tuberosum* L.) ranks the 6th place of food crops in term of acreage in Madagascar. Its production is 280,000tons with 28,000ha on 2006. During the last years, a late blight epidemic (*Phytophtora infestans*) occurred during the rainy season 2006-2007. This epidemic damaged the potato crop and the production decreased by 30%. A trial was intiated to manage lateblight with the following objectives: (i) to evaluate the resistance of cultivated varieties and clones of potato to this disease and (ii) to identify the behavior of potato varieties cultivated by the farmers. Two themes have been conducted on rainy season 2009-2008 and 2008-2009 which the first is to determine the behavior of potato

cultivated varieties against blight. Fifteen varieties were tested at Mimosa station and at two other sites (Androkavato and Betafo). The second aspect was to evaluate 16 potato clones from CIP Lima Peru. Late blight blight disease score at the station was done at intervals of 7 days until the value of late blight attack reached 100% in the suspceptible variety. However, the scoring interval was 14 days at on-farm trial. The results show that the most of local varieties were susceptible to late blight and certain improved varieties like Meva, Diamondra. New clones gave a resistant rating against blight. These include: CIP396038 (U12), CIP 396043 (U13) and CIP396046 (U14) all of which gave mopderate tuber yields. Some clones were resistant to late blight like CIP395112.19 (U5) and CIP396038 (U2) with their yield between 20 and 30t/ha in dry season and 15 to 20t/ha in rainy season. In conclusion, these experiments indicate differences among varieties and clones in response to late blight. The clones presenting a high tuber yield merit to be continued before to official variety release and dissemination.

Key words: clones, late blight, potato, varieties,

TH3ABS218

Current status of sweetpotato virus disease and its associated vectors in post-conflict region of eastern of Democratic Republic of Congo

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Abstract
A study survey was recently (June 2011-November 2012) conducted in various sweetpotato production villages of Kabare, Kalehe, Walungu, Uvira, Kalonge, Idjwui territorie of south – Kivu Province to determine the status of sweetpotato virus disease (SPVD) incidence and its vectors. SPVD incidence ranged from low to high (10.56- 89.41%) from highland to lowland zones. SPVD symptom expression and severity were highly variable both within and between territories. Whitefly (*Bemisia tabaci*:Aleyroididae) but not aphids were observed in all farmers' fields visited and their abundance varied markedly between locations(villages and territories). In Uvira and Kabare territories, sweetpotato chlorotic stunt virus (SPCSV) was serologically detected in 47.9% of the fields sampled and sweetpotato feathery mottle (SPFMV) in 67.23-78.65% often in dual infection. Sweetpotato mild mottle virus (SPMMV), sweetpotato mild speckling virus (SPMSV), sweetpotato chlorotic fleck virus (SPCFV) and sweetpotato virus G (SPVG) occurred in low to medium frequencies in all other territories except Walungu. However, SPCSV was detected in (100%) of the samples collected in Kalehe territory followed by SPFMV (59.7%). The nature of SPVD incidence, symptom severity, whitefly, and aphid abundance observed in this study suggest the complex nature of SPVD in eastern of DRCongo. Immediate prospects for controlling SPVD will depend on an enhanced understanding of disease variables and their ecological relationships to climate change in DRCongo.

Keywords: Sweetpotato, Eastern DRCongo, whiteflies

TH3ABS241

Behavior of crosses between important Kenya potato (*Solanum tuberosum* L.) varieties used in the study of greening in different potato varieties

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Abstract
Potato cultivars with good production performance and resistance to greening are of great economic importance in the potato industry and a step forward to fight food insecurity in Kenya. However, great losses have been occurring because of greening which is an issue of concern to producers, consumers and processors as well. This occurs when tubers are exposed to light during growth, harvesting, handling and marketing which results into change of the color of the tuber before and after cooking, texture of the cooked tubers as well as their nutritional value. Greening can also be a health hazard to consumers when synthesis and concentration of toxic chemicals in the green tuber occur slowly by slowly with continuous consumption. The greatest concern in this study is the rate of greening in potato tubers in various varieties which is a big threat to economic value of potato as a food of global importance. Fourteen varieties (clones) with various important traits were obtained from the National Potato Research Centre (NPRC, KARI – Tigoni) and crossing was done during the long rain and short rain cropping seasons in 2011 at KARI Tigoni. Crosses were made using diallel mating design in three replications. Fifty crosses in each replicate were made in the field giving a total of 150 crosses per trial. The objective was to assess the behavior of crosses between different potato varieties which were used as parents. Data collected during the two cropping seasons were analyzed using ANOVA to get an index for successful crosses between different varieties and this was evaluated to get seven superior parents (50%) whose crosses were used in screen for greening. The varieties selected were Sherekea, Kenya Karibu, Tigoni, Purple Gold, Cangi, Tigoni long and Dutch Robyjn arranged from highest index to lowest.

Key words – potato, post harvest quality, greening and index

Theme Four

Innovations in postharvest management, processing technologies and marketing systems

TH4ABS164

A Baseline survey of Orange fleshed sweetpotato in Western Kenya

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Abstract
Sweetpotato is among crops mostly grown by small-scale farmers for subsistence in Western Kenya although commercialization of the crop is growing in importance. Kenya Agricultural Research Institute (KARI) Kakamega and its partners distributed Orange fleshed sweetpotato varieties to farmers in Busia and Bungoma districts in 2008. However the extent of uptake of these orange fleshed varieties by farmers was not known. The objectives of this study were to describe the sweetpotato farming system and adoption of orange fleshed sweetpotato varieties grown by farmers' criteria in selection of varieties; and to evaluate farmers' perceptions of constraints and opportunities in sweetpotato production in Western Kenya. A multistage sampling procedure was used to select the study sample. A random sample of 204 farmers was selected from sites. Descriptive statistics was used to analyze data. The results showed that majority of farmers (80.4%) grew sweetpotatoes two times in a year and the second season was the most important for growing sweetpotatoes (63% of respondents). The main purpose for growing sweetpotatoes was for food (80.5%) and most used sweetpotato as a substitute food as indicated by about 65% of the population. Women were responsible for sweetpotato production. About 64% of sampled households had heard about orange fleshed sweetpotato and 38.5% had planted the orange fleshed sweetpotato. Neighbors/family member were the major source of information for those farmers that had heard about orange fleshed sweetpotato.

Keywords: Orange fleshed sweetpotato

TH4ABS112

Acceptability and proximate composition of some sweetpotato genotypes: implication of breeding for food security and industrial quality.

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Abstract
Sweetpotato (*Ipomoea batatas*, L.) is the third most important crop in some part of Africa. Eradication of vitamin A deficiency (VAD) remains a global public health challenges. Fight against VAD can be achieved through, nationwide campaigns for local cultivation, processing and use of these newly bred sweetpotato. Orange-Fleshed Sweetpotato varieties can be promoted for their food security and nutritional value and for their income generating potentials. Proximate composition of fifteen (15) fresh roots of Sweetpotato genotypes: NRSP/O5/3D, CIP440293, CIP440163, NRSP/05/022, NRSP/05/10D, CIP199004-

2,NRSP/05/3B, Centinnial,199034-1, 87/0087, NRSP/05/5A, Ex-Igbariam, Shaba, NRSP/05/7C and Ex-Oyunga, comprising white, cream-yellow and orange- fleshed sweetpotato (OFSP) were evaluated using standard methods of analysis. A 20-member sensory panel was used to evaluate some sensory attributes such as colour, aroma, taste, mouth feel and general acceptability of chips made from these sweetpotato using deep frying and boiling processing methods. The panelists were asked to indicate the degree of their liking using a 9-point Hedonic scale, where 9= like extremely, 5=neither like nor dislike and 1= dislike extremely. These were done in other to determine which sensory parameters can be used to select the varieties that are acceptable to consumers with respect to culinary attributes and industrial quality of the crops, for the Nationally Coordinated Crop Release Projects (NCRP) of pre-release sweetpotato genotypes. The dry matter ranged from 28.87%-CIP440293 to 40.90-NRSP/05/3B; flour yield had the range of 21.15 to 33.57% for genotypes CIP440293 and 87/0087 respectively; starch yield was from 13.16- 22.90-% for CIP440293 and NRSP/05/7C while total fat content ranged from 1.02 (Ex-Igbariam) to 1.72 (CIP440293) g/100g and crude fiber had a range of 0.67g - 2.00g/100g, ash content ranged from 0.50-1.52g/100g in genotypes Centinnial and NRSP/05/5A respectively. Over 70% of the genotypes were high in both flour and starch yield, which is a good indication of Industrial potential use of these sweetpotato. They had high to moderate crude protein content, which ranged from 3.94(NRSP/05/022) to 6.93% (Centinnial). Results of the sensory evaluation show that, the colour of the root matters most (genotypes Ex-Igbariam and CIP440293 in particular) to the sensory panel which was an indication of the consumers' preference and breeding attribute. On general acceptability all the genotypes were acceptable in fried form but some were not in boiled form.

Keywords: sweetpotato, sensory evaluation, genotypes, food security and proximate.

TH4ABS155

Analysis of adoption of improved sweetpotato varieties among farmers in Kenya

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Abstract
The study focuses on the analysis of socio-economic factors that influence the adoption of improved sweetpotato varieties among farmers. The specific objectives are to identify the available new sweetpotato varieties in the study area, sources of information on new sweetpotato varieties, determine the extent to which the farmers are aware of the improved sweetpotato varieties, the influence of socio-economic characteristics of the farmers on adoption of improved sweetpotato varieties and to identify the problems confronting farmers' adoption of new sweetpotato varieties. Data were obtained from fifty (50) sweetpotato farmers of the Central Rift Districts through the use of structured questionnaires. The data collected were analysed using descriptive statistics and regression analysis. It was found that more than half of the respondents (sixty percent) were aware of the improved sweetpotato varieties and have been using them, while fifty four percent of the respondents got their information from extension agents. All the respondents (100%) were aware of the improved sweetpotato varieties. The results of the regression analysis showed that household size, level of education, contact with extension agents, and yield of the improved sweetpotato varieties were the factors that influence the adoption of improved sweetpotato

varieties. The major constraints identified were lack of planting materials, lack of contact with extension agents and lack of market for produce. It is recommended that vine seed multiplication should be promoted at farm level through use of existing farmer groups, efforts should be made to make credit accessible to farmers, and there should be dissemination efforts to introduce new sweetpotato varieties to farmers.
Key words: Improved sweetpotato varieties, regression analysis, socio-economic factors, Kenya

TH4ABS134

Analysis of sweetpotato innovation systems in South East Nigeria: implications for policy actions

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Abstract
Sweetpotato *(Ipomoea batatas)* is the third major root and tuber crops in Nigeria after cassava and yam. Abundant potential of sweetpotato for domestic and industrial uses has been established through research which enlists it as an important crop for food and nutritional security in Nigeria. Consequently, in Southeast Nigeria, sweetpotato in recent times has attained some strategic relevance in the food and farming systems of farmers. However, advances in harnessing the crop's potential in the zone to a large extent depend on the functionality of its innovation system. Sweetpotato innovation system in Nigeria is comprised of four major components namely: research, extension, farmers and input agencies. However, other organizations like the university, National Food Reserve Agency (NFRA) as well as local government authorities (LGA) also play some subsidiary roles in the system. Thus development, transfer and utilization of the crop's technologies are determined by the effectiveness of the synergy among these components. This paper seeks to analyze sweetpotato innovation system in the zone with a view to ascertaining the strength of linkage among the components as well as critical constraints associated with the system in the zone. The study involved interaction with major stakeholders drawn from Research, Extension, Farmers and Input organizations in the southeast, Nigeria. Through use of a structured questionnaire, a total of 113 respondents provided vital information needed for the study. Results were mainly descriptive although certain rated responses were further categorized into 3 major groups like "strong, fairly strong and weak". The results showed that on the average, there is a fairly strong linkage existing among the major components of sweetpotato innovation system in the zone thereby contradicting popular perception that weak linkages exist among major stakeholders in the system. Results also revealed that issues like poor funding; inadequate coordination and insufficient political will from Government were serious constraints to the functionality of sweetpotato innovation system in Southeastern Nigeria. It is thus recommended among others that appropriate policies should be put in place to ensure sufficient funding as well as mustering sufficient Governments' political will for the system in order to facilitate the harnessing of the abundant potential of sweetpotato, and the development of its value chain for food security and economic empowerment of farmers in the zone.
Key words: Innovation System, Research, Extension, Farmers, Input, Policy,

TH4ABS014

Assessment of the sweetpotato market and profitability in southern Ghana

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Abstract

This research work studied the market of sweetpotato in the Southern parts of Ghana. It analyzes the market intermediaries, marketing constraints and the consumption of sweetpotatoes. The study was carried out in August 6-12, 2012, in the southern Ghana. Snowball sampling technique was used to interview 41 marketers and agro-processors and 53 sweetpotato farmers at Accra, Daminasi, Gomoa Potsin, Jukwa, Kasoa, Mankessim, Mori Junction, Winneba Junction, Komenda, and Kakokrom. Using cross-sectional data obtained from structured survey and focus group discussions as well as expert consultation in the ten production areas and marketing centres, the study found that sweetpotato is characterized by (i) high demand (ii) high market profitability and (iii) low supply. The sweetpotato varieties with high dry matter content, yellow-flesh and medium size were preferred. Accra is able to source and supply sweetpotato all-yearround. Although there is high demand for sweetpotato, the supply fluctuates seasonally. The major market intermediaries were found to be producers (smallholder farmers), wholesalers (women supervised by market queens), agro-processors (who fry), retailers (supermarkets, open market stall and roadside retailing) and consumers (households). Producers generally preferred selling to customers who purchase all their produce in bulk. The most important among the market intermediaries in terms of volume traded were the agro-processors who purchased about 56% of the supply. Furthermore sweetpotato prices fluctuated according to the rains, high in the lean and low in peak season. The study found out that supermarkets retailed sweetpotato that farmers considered low quality in terms of physical features like size and bruises relatively high prices. Additionally, a marginal analysis of sweetpotato showed that sweetpotato marketing was profitable in 2011 major season, spanning from April to August with the average retailer, wholesaler, and farmer earning$0.23, $0.29 and $0.27 per kilogram of sweetpotato traded respectively. The results also show that the average sweetpotato farmer's share of the retail price of $0.57 per kilogram was 46%. Lack of market information(56% or respondents) was the major market constraint. The foremost constraint of sweetpotato processors (86% of respondents) was low dry matter content of some varieties that makes the sweetpotato soggy when processed and thus, requiring more oil to fry.

Keywords: sweetpotatoes, market, supply pattern, market players, customer behavior, margins, constraints

TH4ABS071

Building a Sustainable Sweetpotato value chain: Experience from Rwanda Sweetpotato Super Foods Project

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Abstract
Sweetpotato is widely grown in almost all agro-ecological zones of Rwanda, where it is prized by most resource-poor farmers as a reliable, low input, food security crop but with limited commercial potential. The bulkiness, lack of processing technologies and lack of market of at the peak of sweetpotato production are reported as major constraints by producers and policymakers for scaling up. The strategy for cleaning and availing of elite selected Gihingumukungu and Cacearpedo orange fleshed sweetpotato varieties for promotion to farmers, based on the ability to yield storage roots of acceptable consumer quality, and to produce planting material for continued propagation through a seed system was initiated and adopted by organized farmers' groups in three districts. Processing sweetpotato into products offers the opportunity to increase demand for the crop and create value addition. In collaboration with different stakeholders, the Rwanda Sweetpotato Super food research project is investigating how to effectively connect smallholder sweetpotato producers to agro-processors through effective value chains. Tasty and acceptable sweetpotato products have been developed, processed and promoted for proof to different rural, semi-urban and urban consumers. Farmers in different groups and individual contracting farmers' are producing and sale fresh roots. Akarabo biscuit and Mandazi doughnut sweetpotato based processed products are produced and marketed by Urwibusto Enterprises.

Key words: Value chain, Orange fleshed sweetpotato, sweetpotato products

TH4ABS232

Development of a low cost two wheel tractor operated potato planter for small farmers in South Asia

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Abstract

A two wheel tractor operated cup type potato planter was developed in Bangladesh Agricultural Research Institute; Rajshahi which can plant whole tuber potato seeds as well cut piece potato seeds automatically in furrows at predetermined regular intervals. Potato planter maintains a single row of spacing 600 mm and maintains average seed to seed distance 250 mm. The planter is lighter weight and suitable for small farmers especially in South Asian countries. This planter singularizes the seed by a series of cups equally spaced that pass vertically through the secondary seed box for taking one piece of seed per cup. The planters perform four mechanical functions simultaneously, viz., opening furrow, metering the seed, and making beds along with covering the seed. Performance of the planter was evaluated in the farmer's fields to determine the effect of forward speed and seed sizes on the uniformity of spacing and seed missing during 2011-12. Four speeds and three seed sizes were varied to evaluate the planter. Uniformity of spacing varied with the increase of operational speed. It was found that forward speed of 2.4 km/hr is the best in respect of uniformity of spacing and missing seeds. Seed sizes of 35mm were found best in respect of uniformity of spacing (92%) at the speed of 2.4 km/hr. Field demonstrations were conducted at on station of Rajshahi farm. The average effective field capacity of cup type planters were 0.10 ha/hr and missing seed was 3%. Potato planter requires 4 man-days/ha compare to 60 man-days/ha in conventional manual planting method. The breakeven point of the potato planter is 7.2 ha. An owner need to cover 7.2 ha land yearly for no loss no profit margin.

Key words: Two wheel tractor, potato planter, effective field capacity, uniformity of spacing, breakeven point

TH4ABS009

Diversity and characteristics of potato flakes in Nairobi and Nakuru, Kenya

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Abstract

Potato flakes are some of the most important form of dehydrated potato products that can be used in different ways including substitution for fresh mashed potatoes. Unlike French fries and crisps whose consumption patterns and diversity is well established, little or no information can be obtained on flakes in Kenya. This study was, therefore designed to assess the diversity and characteristics of potato flakes in Nairobi and Nakuru, Kenya. Potato flakes diversity and characteristics were determined through a structured questionnaire administered to attendants in 148 retail outlets (supermarkets and shops) followed by sampling and laboratory analysis of the available brands. Of all supermarkets surveyed, only 3.4% stocked potato flakes. There were only 2 brands of flakes, one imported and another, local brand. The sales were reportedly low due to the high cost (55%) of the products, lack of public awareness of the product (35%) and inadequate supply (15%). The oil and moisture contents of potato flakes from supermarkets in Nairobi and Nakuru significantly ($P<0.05$) differed between the brands being generally lower in the imported brand compared to local brand, ranging from 0.13% to 0.32%. There were no significant ($P>0.05$) differences in levels of sodium chloride with the maximum recorded being 2.11% in imported flakes. The moisture content ranged from 8.52% to 10.51% in local and imported

flakes brands, respectively. The sale of potato flakes can, however, be increased if the processors produced smaller unit weight packages that are more affordable and create awareness to the general public consumer.
Key words: Flakes, lightness**,** mash potatoes, dehydration

TH4ABS008

Effect of variety and processing method on quality of traditional flour ('elubo') and paste ('amala') from sweetpotato

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Abstract
'Amala' is a generic term in Nigeria, used to describe a thick paste prepared by stirring flours ('elubo') from yam, cassava or unripe plantain, in hot water, to form a smooth and thick consistency. The 'amala' is consumed with vegetable soup as a complement. To overcome the problem of high perishability of fresh yam or cassava, these crops are processed into 'elubo' by soaking in cold water or parboiling, depending on the crop, followed by drying and milling. In order to increase the utilization of sweetpotato roots and to overcome its high perishability, varieties of sweetpotato (SP) roots; two yellow-fleshed (each from Nigeria and Uganda) and one orange-fleshed (from America), were processed into 'elubo' using parboiling and soaking methods. The chemical, functional and pasting properties of the 'elubo' (SPE) and sensory acceptability of the 'amala' were investigated. Multivariate General Linear Model was performed to determine the individual and interactive effects of variety and processing method on the attributes measured. The interactive effect of variety and processing method had significant effect ($p<0.05$) on all the attributes except yellowness, setback viscosity and peak time. A significant ($p<0.01$) correlation ($r = 0.99$) exists between total sugar and water solubility of SPE. Acceptable sweetpotato 'amala' with average sensory acceptability score of 7.5 were obtained from yellow-fleshed SP varieties irrespective of processing method. 'Elubo' that produced acceptable 'amala' were characterized by low values of protein (2.20-3.94%), fibre (1.30-1.65%), total sugar (12.41-38.83 µg/mg), water absorption capacity (168-215), water solubility (8.29-14.65), swelling power (0.52-0.82) and high peak time (6.9-8.7 min). 'Elubo' from orange-fleshed variety were characterized by high values of protein (4.52-4.60%), fibre (4.39-5.37%), total sugar (172.85-233.58 µg/mg), water absorption capacity (273-703), water solubility (44.62-52.40), swelling power (0.89-3.71) and low peak time (4.3-5.5min). This study has shown that for an acceptable 'amala', variety was a more important factor than processing method. Properties of sweetpotato 'elubo' required for acceptable 'amala' were also established. These results has practical applications for quality control during commercial production of sweetpotato 'elubo'.

TH4ABS022

Evaluation of sensory quality characteristics of muffins developed from sweetpotato flours

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Abstract
This work was carried out to develop muffins from the sweetpotato flour and to determine the effects of processing on the sensory characteristics of muffins derived from sweetpotato flours. Two sweetpotato varieties, one improved (Slipot III) and one local (Pa-Usman) were processed into flour using two processing methods: sweetpotato flour from no limed Chips (SFNLCs: untreated) and Sweetpotato Flour from Limed Chips (SFLCs: treated) were used. Potato slices of the varios varieites were immersed in lime juice before sun drying to improve flour whiteness for 35 minutes in the ration 16/600. 60% each of the treated and untreated sweetpotato flours obtained from each variety and 40% wheat flour composite and wheat flour were used to prepare muffins by creaming method. Fifteen trained panelists randomly selected from Njala Agricultural Research Centre and Njala University evaluated the samples using a five point Hedonic scale. Results generally indicated that processing methods and variety significantly ($p=0.0359$) affected the quality (taste, flavour, colour and texture) of muffins developed. Sweetpotato/wheat flour composite muffins indicated no significant ($p>0.05$) difference in terms of taste with that of the 100% wheat flour. The mean scores of composite Muffins developed from SFNLCs exhibited higher values than those from SFLCs for all the sensory characteristics, except for colour. However, the differences were not significant with respect to the local variety but slightly significant with respect to the improved (Slipot III) variety. The results of the sensory attributes of the muffins developed from various sources indicated that wheat/sweetpotato composite flour can be used to prepare quality flour products such as muffins with no significant variation in consumer acceptability. Promotion of recipe developed and other stakeholders' involvement especially marketers, will enable sustainability and improvement in the livelihoods of farmers and the general populace in Sierra Leone.

Key words: *Characteristics*, Evaluation, Muffins, *Sensory,* Sweetpotato, *Varieties*

TH4ABS120

Feasibility of Exporting Potatoes from Eastern Africa: The Case of Ethiopia, Kenya and Uganda

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Abstract

This study evaluated the potential of Ethiopia, Kenya and Uganda to export potatoes in the form of ware (eating potatoes), as seed or as processed potato products. Potato was considered an important crop in each of the three countries but trading of potato beyond the borders of each country had not been systematically explored. This study sought to document the presence and magnitude of potato trade (as seed, ware and products) in the three countries and to explore the bottlenecks and strengths of each country in the export of potatoes; with the objective of providing practical suggestions on how to make potato an exportable commodity. Data was collected from secondary sources and from key informant interviews using checklists. Export of the various forms of potato varied in the 3 countries. Ware potatoes were being exported from all the three countries but it was mainly seasonal, cross border trade that was of low quality and of low value so that export potato prices did not differ from prices in the local markets; creating a lack of incentives to produce quality ware potatoes for export. The export of potato seeds was constrained by lack of certified seed production in Ethiopia and Uganda. The 'quality declared seed' grown in Ethiopia and Uganda cannot be quality guaranteed by an independent certifying authority and this limits its exportation to other countries. Certified seed production was done only in Kenya with most of it being used locally. Only minimal quantities were exported mainly to neighboring countries. Processed potato products were exported only from Kenya as processing of potatoes was minimal in Ethiopia and Uganda and none of the processors in Ethiopia and Uganda even met the quality standards set for potato products in their respective countries. Ethiopia and Kenya have opportunities to strengthen their current export efforts. Ethiopian ware potato exports to neighboring African countries and to specific Middle Eastern countries can be strengthened. Kenya needs to investigate opportunities for increasing potato product exports to neighboring countries. Local consumption hinders exports with Kenya and Uganda needing to strengthen seed and ware potato production so they can each produce more optimally and so export surpluses.

TH4ABS213

Potato innovation system development with farmers: Lessons from activities of CASCAPE Project, Northwestern Ethiopia

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Abstract
Potato is a food security crop. It plays an important role in addressing the seasonal food deficit experienced during the months of August through September because of its short crop cycle (90-120 days). Potato has high yield potential and can give more than 30 tones ha^{-1}. The crop has huge demand in the local market and it is known for its high nutritional value. However, several constraints have hindered dissemination of the crop. Among others, traditional potato production system; high incidence of disease and pest (bacterial wilt and late blight); shortage of seed for adaptable and disease tolerant varieties; low productivity of local varieties; limited knowledge on post harvest handling and management (poor storage and transport facilities); lack of skill on food preparation and utilization and poor innovative technology transfer systems are the major ones. The capacity building for scaling up of evidence based best practices for Ethiopia (CASCAPE) project focused on developing potato innovations systems from planting to marketing with farmers. The procedures followed were: 1) participatory evaluation and demonstration of improved potato technologies. In the first year of CASCAPE project intervention, seven different released varieties were demonstrated and evaluated by farmers' research group (FRG) organized in *South Achefer* and *Burie* districts. As per farmers' evaluation for yield and cooking quality, *Belete* variety was selected. 2) Participatory informal seed multiplication and dissemination. Based on the first year result of evaluation, the project multiplied seed of *Belete* variety. 3) Scaling-up the potato production package to other farmers' fields. The multiplied seed was distributed to selected eight farmers who are chosen from the four FRG team in the two districts. Around each farmer, 20 famers were organized as a new FRG team. 4) Construction of diffused light store (DLS). Farmers received training on the construction of DLS and constructed 8 stores. 5) Training on food preparation. Farmers were given training on food preparation by development agents. 6) Linking with the market. Large tubers were sold to the market for food while small sized tubers were stored in DLS and will be sold for planting next year among FRG members and beyond. Following this approach yield of potato was raised from 7 to 39 tons ha^{-1}. From the two years experience we have seen that the innovation system was adopted by farmers and development agents and we believe that potato will become an important crop in the study area.

Key words: diffused light store, farmers' research group, potato innovation system, scaling up

TH4ABS175

Potato Production Efficiency through Contract Farming in Kenya: The Case of Bomet and Molo Farmers

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Abstract
A study on contract farming among 137 potato farmers of Bomet and Molo districts was done to evaluate its impact on potato production and productivity. Descriptive and analytical statistics on farmers' socioeconomic, geographical parameters were used. Stochastic frontier model analysis was used to evaluate farmers' attributes that affect their production efficiency under contract arrangement. Contract farming enhanced potato productivity and income and acted as an incentive for farmers to supply niche market and increased their demand for farm inputs. Due to lack of sound organized market of potatoes, there was inefficiency in potato production causing decline in input demanded. To overcome these problems farmers formed organized production and marketing system under contractual arrangement with the buyers. This led to increased demand for quality inputs and enhanced credit accessibility. In response to the challenges in contract farming, a tri-partied system of service providers was constituted for arbitration. Contract farming in the districts has shown that farmers could produce sufficient quantities of high quality potatoes that fetch premium price if they are organized to do so. However rules on contracts have to be agreed on and followed by all participating players. Contract farming involved extra costs but accrued benefits were higher due to improved productivity, efficiency and premium price paid under contract. There was also reduction in processing losses due to deliver of quality tubers (reduced rotting, browning and peeling losses by 0.78, 0.3 and 0.75%, respectively) compared to pre-project period. Attributes of respondents like being household head, had training, large family size and contract farming participation significantly enhanced production efficiency while credit access, age of respondent had significant negative effects on production efficiency.

Key words: Contract farming, quality input, productivity, production efficiency

TH4ABS080

Price integration of sweetpotato marketing: implication for an efficient marketing system in Nigeria

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Abstract
The study was carried out in 2010 in south east agro ecological zone of Nigeria to determine the degree of market integration and problems associated with sweetpotato marketing. It was informed by the fact that in a food market economy like Nigeria, an efficient, integrated and spatial pricing system usually leads to economic growth. This is true if it effectively minimizes the price differential in traded product due to costs of transportation, storage and processing over time and space. A Multistage random sampling technique was used in selecting states, respondents and markets. A total of four states, 360 respondents comprising 240 retailers 120 wholesalers and 24 markets were randomly chosen. The list of wholesalers and retailers who pay stallage fees formed the sampling frame. Primary data were collected using structured questionnaire and interview schedule. Analyses of data were done with simple descriptive statistics and bivariate correlation coefficient. The result of the finding revealed that the markets are spatially separated but not fully integrated. The major problems of sweetpotato marketing identified include lack of credit facilities, perishablity of sweetpotato, lack of good processing machines, inadequate market stalls, high transport cost, bulkiness of the commodity, lack of storage facilities and attitude of law enforcement agents in order of severity. It was concluded based on the findings of this study that generally the markets in the zone are integrated but not yet perfect. It is therefore; recommended that structural lending reforms are advocated and provision of infrastructural facilities to enhance marketing activities and efficiency in zone. Marketers are also encouraged to form cooperatives for capital-build up, to establish a bulking centre and to enjoy economy of large scale.

Keywords; Price, Integration, Sweetpotato, Correlation and Marketing

TH4ABS045

Production and quality evaluation of yellow-flesh sweetpotato starch tapioca grits

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Abstract
Tapioca grit is partially gelatinized dried cassava starch, which appears as flakes or irregularly shaped granules. It is consumed in many parts of West Africa, and widely accepted as a convenient diet. Sweetpotato is highly underutilized in Nigeria and many West African countries. Hence, producing tapioca grits from sweetpotato starch has the potential of adding value to an underutilized plant species in Nigeria. This study was therefore conducted to produce and evaluate the quality of tapioca grits made from yellow-flesh sweetpotato starch. Starch was extracted from yellow-flesh sweetpotato tuber and its functional and pasting properties were determined. The starch was then processed into tapioca grits and analyzed for proximate, functional, pasting, and sensory properties using standard laboratory procedures. Tapioca from cassava starch was used as control. The peak viscosity, trough, breakdown, final viscosity, setback, peak time and pasting temperature of the starch samples ranged from 312.05-517.35 RVU, 174.00-303.85 RVU, 138.85-213.50 RVU, 243.35-420.30 RVU, 69.35-116.45, 4.63-5.07 RVU and 74.28-82.38 RVU, respectively. The water absorption capacity, dispersibility, pH, bulk density and wet ability of the starches ranged from 8.07-10.53 %, 64.00-78.00 %, 4.27-9.34, 0.52-0.92 g/ml and from 108.33-162.67 s, respectively. The moisture, ash, protein, fat, crude fibre and carbohydrate contents of the tapioca grits ranged from 8.57-10.13 %, 0.67-0.80%, 0.23-0.38%, 0.26-0.39%, 0.20-0.25% and from 88.18-89.94%, respectively. The moisture, protein and carbohydrate contents of sweetpotato starch tapioca grits were significantly different P<0.05) from that of tapioca grits from cassava starch while ash, fat and fibre contents were not significantly different (P>0.05). The functional properties of the yellow-flesh sweetpotato tapioca grits were significantly different (P<0.05) from cassava starch tapioca grits. pH and bulk density of the sweetpotato starch tapioca was found to be higher than that of cassava starch tapioca grits. The colour, flavour, taste, texture and overall acceptability of the tapioca grit samples ranged from 6.55-8.30, 6.75-6.90, 6.95-7.15, 6.30-7.80 and 7.15-7.40, respectively. The sensory properties of the tapioca grits made from yellow-flesh sweetpotato and cassava starch showed that sensory parameters were not significant (P>0.05) except for colour and texture. Cassava starch tapioca was the most preferred in terms of colour, texture and overall acceptability while the flavour and taste of the sweetpotato starch tapioca was the most preferred. The study concluded that tapioca grits of acceptable functional and sensory qualities can be obtained from yellow-flesh sweetpotato. Findings from this study are useful in finding alternative economically viable uses for orange flesh sweetpotato in West Africa.

TH4ABS110

Promotion of vitamin A-enriched sweetpotato for production by small-scale commercial farmers in South Africa

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Abstract
The National Department of Science and Technology (DST) funded a project on demonstration agronomy of vitamin A-enriched sweetpotato in South Africa for job creation, enterprise development and ultimately addressing food security and malnutrition, particularly vitamin A deficiency (VAD). Locally VAD affects 64% of 1-9 year olds and 27% of women at childbearing age and is considered as a public health problem. Government policy currently has a strong focus on small-scale commercial enterprise development. This paper reports on developing expertise in nursery management and handling practices for good quality cuttings, as well as agronomic and postharvest practices for small-scale commercial sweetpotato farmers, based on experiences of the well-developed commercial sweetpotato industry in South Africa. New cultivars with high yield, good root quality and sweet, dry taste were promoted focusing on orange cultivars due to their high provitamin A Content, but not excluding cream cultivars. The project entailed setting up of infrastructure and development of nursery production plans for four nursery sites in four provinces. Disease-tested stock plants of seven new cultivars were propagated by the sweetpotato scheme at ARC-Roodeplaat and distributed to DST-ARC supported nurseries at ARC-Roodeplaat itself, and at the Universities of Fort Hare, Venda and Zululand. Training was provided to small-scale commercial farmers/farmer groups on nutritional value of new vitamin A-enriched cultivars, cultivation practices, as well as handling, grading and packaging of roots for informal markets. Large numbers of cuttings (600,000 cuttings including new popular cream-fleshed cultivars) were issued by the nurseries. These predominantly went to outreach activities of various organs of state purchasing cuttings to supply evolving commercial farmers. However, a number of farmers themselves purchased cuttings for 1-2 ha production blocks from the nurseries. Experiences of three projects with small-scale commercial cultivation of vitamin A-enriched cultivars (0.3 – 1 ha), in different climate and socio-economic settings, are presented depicting the development of a competitive system for small-scale commercial farmers which is effective for informal marketing. The key attributes being improved vine management systems, quality care at harvest time towards delivering quality fresh produce.

Keywords: cutting production, high yield, quality fresh produce, orange-fleshed sweetpotato, technology popularization

TH4ABS026

Scaling up of orange fleshed sweetpotato technologies using participatory market chain approach in Siaya county- Kenya

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Abstract
Sweetpotato plays a key role on food security in developing countries. It requires low inputs, grows and produces under diverse weather conditions and more so it is the least expensive source of vitamin A. Orange Fleshed Sweetpotatoes (OFSP) technologies have been developed and promoted to improve food security and nutritive values of the rural population. However, adoption of OFSP technologies has remained low. It is against this backdrop that the Agricultural Information System project opted to use the Participatory Market Chain Approach (PMCA) to strengthen the Orange Fleshed Sweetpotato (OFSP) value chain market in Western Kenya. The objectives of the study were; 1) To strengthen interactions among OFSP players along value chain continuum, 2) To enhance adoption of OFSP technologies. The study was conducted in Gem and Ugunja districts in Siaya County. The PMCA methodological structure was followed. The activities were divided into three phases. This paper will focus on phase one and two only. Phase one involved market chain survey. Purposive sampling was used to select the actors along the sweetpotato value chain. A total of 37 actors were interviewed using a semi-structured questionnaire. Phase two involved participatory analysis of potential joint OFSP business opportunities. Results indicate that 35% of the sweetpotato produced in Gem and Ugunja is OFSP. Though more women (80%) are involved in sweetpotato root production it is mainly on small scale. Three thematic groups were formed based on the potential business opportunities realized in phase one. The groups include; OFSP seed production market, OFSP root production market and OFSP processed products market. More women are involved in sweetptato root production though at small scale. OFSP entrepreneurship should be promoted more to improve the livelihoods of women who are majority in the sweetpotato value chain.

Key words: Orange Fleshed Sweetpotato, Participatory Market Chain Approach

TH4ABS176

Socioeconomic constraints to Potatoes value chain development in the Democratic Republic of Congo: Experience from South-Kivu

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Abstract
During the last decade two apparently contradictory phenomena have been noticed in Potatoes value chain in the DRC: a spectacular growing of potato consumption and a dramatic slowing down of potato production trends. A study was conducted in South Kivu province to characterize the status of Potatoes supply chain. Results reveal that the existing technological and institutional framework does not favour the optimal exploitation of emerging and potential value chain development opportunities. A holistic approach combining value adding, productivity enhancement, post harvest measures and market development linkages is suggested to support value chain functioning

Key words: Market integration, value chain, technological framework, institutional framework

TH4ABS107

Transaction costs and agricultural household supply response of sweetpotato farmers in Kwara state of Nigeria

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Abstract
Transaction costs arise in the course of market exchange and involve the cost of information, search, negotiation, screening, monitoring, coordination and enforcement. That is, costs related exclusively to coordination of exchange among market actors distinct from the physical costs of transferring goods, such as transport, handling and storage costs. Transaction costs vary by individual, leading to heterogeneous market behaviours. This paper examines the relationship between transaction costs and household supply response among sweetpotato farmers in Kwara State. Multistage random sampling technique was

employed in selecting one hundred and twenty respondents for the study. A structured interview schedule was used to collect data from the respondents. Data were analyzed using descriptive statistics and an estimation Cobb-Douglas regression model. The descriptive analysis revealed mean age of respondents as 43.4 years which is the predominance of medium aged people between farming population, 80.8% were male and 94.1% were married. Only18.3% of them had no formal education at all and more than half of the respondents (65%) have farming as their main occupation. It also revealed the year of farming experience of the respondents is averagely 25 years and about 80% of them have been planting sweetpotato for the period between 11 to 40 years. It was deduced that 39.2% of the respondents cultivated less than, or one hectare of land, 52.5% cultivated 1 to 2 hectares while 8.3% cultivated above 2 hectares. The highest farm size cultivated is 4 hectares which falls under small scale farming categories (0.10 to 5.99 hectares). This implies that they grow sweetpotato on small scale level. This confirmed the predominance of smallholdings farming in Nigeria and indicates low output as a result of their source of finance. Majority (70.8%) of sweetpotato farming household used their personal savings which is usually small and accounts for small scale cultivation. The elasticity of supply response showed that with respect to price, area, negotiation cost, agents fee, harvesting cost, assemblage cost, storage cost, transportation cost and land transactions cost, a 10% change in each of the variables result to7.2%, 10.5%, 1.0%, 13.4%, 4.8%, 0.8%, 1.2%, 1.5% and 9.3% respectively for respondents. Adjusted R-squared (R^2) for the regression analysis was 0.734, showing that 73.4% of the variations in quantity of sweetpotato supplied by respondents were explained by the estimated variables. Data analysis showed that significant relationships exist between transaction costs and agricultural household supply response in the study area.

Key Words: transaction costs, household, supply response and sweetpotato.

TH4ABS077

Vacuum frying processing technology improves quality attributes of fried sweetpotato chips

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Abstract
This work investigated the effect of sweetpotato (SP) cultivars (EX-OYUNGA, 440216 and SPK 004), type of frying oil (Groundnut, refined, bleached and deodorized (RBDO) and palm oils) and vacuum frying conditions (temperature-108, 122 and 136^{o}C, pressure-6.54, 13.21 and 19.88kPa and time-2, 6 and 9min) on the quality attributes of sweetpotato chips. Response surface methodology (RSM) technique based on Box-Behnken design was used to optimize the vacuum frying processes and study the effects of raw material compositions on quality of fried chips. Twenty combinations including five replicates of the centre points were performed in random order. Seven responses such as oil and moisture contents, beta-carotene, texture, lightness, redness and yellowness were considered to evaluate the effects of the variables on SP chips. Fried SP chips from the optimized vacuum frying conditions were then compared with atmospheric fried samples using the concept of equivalent thermal driving force (ETDF). From the results obtained, significant differences (P<0.05) existed in

sweetpotato varieties and frying oil composition with the use of EX-OYUNGA and groundnut oil producing fried chips with acceptable quality attributes. Frying temperature and time as well as vacuum pressure have significant effect on beta-carotene, texture, lightness, redness and yellowness with coefficient of determination (R^2) of the models for the responses investigated varying between 0.7179 and 0.951. The optimized coded vacuum frying conditions for the adopted cultivar and frying oil were 0.47, 1 and -1 for frying temperature, vacuum pressure and frying time based on desirability concept of 0838. This choice was based on fried chips of lower oil and moisture contents, high level of beta-carotene retention, lower breaking force, lighter and more yellow. When the optimized vacuum fried samples were then compared with atmospherically fried samples, the former retained about 35% beta-carotene, improved texture, lighter and more of golden yellow colour. Hence, vacuum frying could be an alternative to produce nutritious deep fat fried SP chips compared to the traditionally produced atmospheric fried samples.

Keywords: Sweetpotato, vacuum frying, atmospheric frying, quality, frying oil, β-carotene, texture, colour

TH4ABS244

Marketing of orange-fleshed sweetpotato in Western Kenya: Using innovation platforms

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Abstract
The orange-fleshed sweetpotato (OFSP) is the cheapest source of β-carotene important for the control of vitamin A deficiency which is a major nutrition problem in Kenya. Despite its importance the varieties were rarely found in the markets.This was because of the low volume of fresh roots produced and lack of information among the market chain actors on the benefits of the OFSP. The Dissemination of New Agricultural Technologies in Africa (DONATA) project was initiated in western Kenya in 2008 to enhance the utilization of OFSP among communities in western Kenya using Innovation Platforms for Technology Adoption (IPTAs). The IPTAs served as institutional mechanism bringing together different stakeholders for scaling out/up OFSP technologies. The platforms were made up of different actors along the sweetpotato value chain. The IPTAs created market for OFSP through awareness creation among farmers, processors, traders and consumers in western Kenya on the economic and nutrition benefits of OFSP. The IPTAs also trained 282 farmers, 24 TOTs and 56 traders on OFSP marketing. The farmers were linked to the Siwongo processing company which was processing OFSP roots into flour and chips. The flour and chips were sold to the Azuri Health and Kirinyaga Millers based in Nairobi, respectively. Fresh root producers were organized into clusters for the purpose of bulk selling of roots to the markets. The production of flour and chips rose from half a ton per month at the start of the project to five tons/month by year four of the project. The processor also contracted farmers to produce and supply the the firm with fresh roots. The market for OFSP vines also increased as the demand for the varieties increased. The mian markets for the vines were the Kenya Horticultural Competitive Project (KHCP) and One Acre Fund (OAF) project. Seed producers sold vines worth US$ 20,000 to the OAF in one season.

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Key words: Innovation platforms, awareness creation, OFSP flour, sale of planting vines.

TH4ABS004

Potential of processing potato flakes from popular Kenyan potato varieties

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Abstract
There are tonnes of potatoes that go to waste during seasons of glut and farmers are forced to sell their produce to middlemen at low prices due to short storage life of the raw tubers. Processing potatoes into dehydrated products such as potato flakes after harvesting will be one of the ways to overcome the problem of inadequate and inappropriate bulk storage of raw potatoes. Potato flakes are known to be shelf stable and hence assure users of the availability of the produce all year round. This study was therefore instituted to establish the potential of processing potato flakes from selected popular Kenyan potato varieties. Five potato varieties (Tigoni, Dutch Robjin, Desiree, Kenya Mpya, and Sherekea) which are popular commercially were used in this study. The varieties were harvested after maturity and processed into potato flakes before evaluation of retained vitamin C, color, oil and moisture content, and sensory attributes. The varieties used in this study had dry matter contents ranging from 18.2% to 23.7%. Oil content of the flakes was significantly (P≤0.05) lower in Dutch Robjin (0.23%) compared to Desiree (0.76%). Oil content of flakes significantly (p=0.011) but negatively correlated (r=-0.956) with dry matter content of the raw potatoes. Reduced ascorbic acid (vitamin C) in raw tubers differed significantly (P≤0.05) among the varieties ranging from 90.37 mg/100g in Kenya Mpya to 127.56 mg/100g in Sherekea. The vitamin decreased in flakes, the reduction being higher in Kenya Mpya (60.34%) and Sherekea (71.71%) compared to Tigoni (18.15%) and Desiree (23.26%).On the overall, Dutch Robjin was the best variety to process flakes followed by Desiree and Tigoni. Sherekea was unacceptable while Kenya Mpya was barely acceptable. Promotion of these varieties for fakes processing will not only diversify range of potato products, but will also add value to local potatoes.

Key words: Flakes, drum drying, reduced ascorbic acid, potato varieties.

TH4ABS007

The effects of storage conditions on the quality of sweetpotatoes

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Abstract
Three sweetpotato varieties (white, orange and pink) bought from a wholesale market and stored at three environmental conditions (50%, 70% and 90% relative humidity levels at a common temperature of 25^{o}C) were used in this study. The aim was to determine the wound healing ability, sugar levels (in g/100ml total soluble solids) weight loss, respiration rates (ml/kg/h), sprouting and pathological decay over a period of four weeks. Determinations were done every week for all parameters except for that of wound healing which was carried out after six and eight days in storage respectively. Wound healing ability was established by lignification assessment using phloroglucinol (1% in 95% ethanol) and concentrated hydrochloric acid. Spouting was determined by manual counting and sprout length by measurement with a metre rule. Respiration rates were measured using Gas chromatography and sugars were determined with the use of a refractometer. Data was analysed by ANOVA using Genstat and means were compared using LSD at 5% significance level. Wound healing ability among the sweetpotatoes was strongly influenced by variety and storage condition ($p<0.001$). The pink variety was the best healer followed by the orange and white variety respectively. Sugar levels were highly significantly influenced by variety ($p<0.001$) and not by humidity. Lignin score correlated strongly with sugar content and was significant at 50% and 70% respectively ($r=0.746$, $p=0.005$; $r=0.696$, 0.011 respectively). Weight loss varied significantly among the sweetpotato varieties and also among the respective storage environment ($P<0.001$). The white variety showed a strong response to humidity than the other two. Respiration rates were strongly influenced by varietal differences ($p<0.001$) in sweetpotatoes but for the storage conditions the influence was only for three weeks. A high respiration rate correlated with a high weight loss among sweetpotatoes. The orange variety however was able to virtually maintain a sound quality throughout the four week storage period. Sprouting also varied significantly among varieties and humidity levels. The pink variety from the three was the most rotting prone when stored at a high relative humidity.

Key words: sweetpotato, relative humidity, variety, white, orange, pink, storage conditions

TH4ABS023

Influence of fermentation time on the proximate and pasting properties of sweetpotato (*Ipomea batatas* L) flour

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Abstract
The work investigated the influence of fermentation time (0, 24, 48 and 72 hours) on proximate and pasting properties of sweetpotato flour. The raw sweetpotato tubers (yellow fleshed variety) were peeled, size reduced into slices (4-5 mm) and soaked (for fermentation) in a stainless steel container with portable water that completely covers the chipped sweetpotato slices. Thereafter, the fermented chips were drained, packed into sacks, pressed (de-watered) and dried in a cabinet drier at 65°C for 9 hours and milled into flour (≤ 250 µm).The results showed that there were significant difference ($p<0.05$) on the effect of fermentation time on the parameters investigated. The result of the proximate analysis revealed that moisture content ranged from 12.56% to 13.79%; crude protein from 7.95% to 13.23%; fat content ranged between 1.18% and 3.46%, 1.32% and 2.39% for crude fibre, 1.39% to 4.28% for ash, 64.08% to 74.37% for carbohydrate and 336.06 to 340.38 for energy (kcal/100g). The pasting profile of the samples revealed that the peak viscosity ranged from 72.25 to 413.17 RVA, trough viscosity 23.00 RVA to 228.83 RVA, breakdown viscosity 8.25 RVA to 184.33 RVA, final viscosity 57.25 RVA to 331.67 RVA, setback viscosity 23.25 RVA to 100.17 RVA, peak time 4.53 mins to 6.49 mins and pasting temperature 61.75^{0}C to 82.15^{0}C. Generally, fermentation has a negative effect on the setback viscosity value of the flour sample as it increases with increase in fermentation time and this might make the flour more susceptible to retrogradation. However, based on the results of the peak viscosity which is an important indicator of the quality characteristics of any starch-based product, it can be concluded that fermentation would have a positive effect on sweetpotato flour especially when the intended use is for product requiring high viscosity.

Keywords: Sweetpotato, fermentation time, proximate, pasting properties.

TH4ABS037

Sweetpotato starch (*Ipomoea batatas*) as a potential source of citric acid

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Abstract
The potential of sweetpotato starch was investigated for the production of citric acid by *Aspergillus niger* using submerged fermentation. The raw potato starch was suspended in distilled water at different concentrations (5, 10, 15 and 10% w/v). The potato slurry was inoculated with spores of *A. niger* and incubated at 30^{o}C for 5 days. The result showed a maximum citrate production after 96hours in 5% potato starch. A decrease in the initial pH 7.6 to 2.8 was noted along the fermentation period. Supplementation of the production medium with Iron (II) gave an enhanced citric acid yield (33g/l) while methanol did not show any significant effect on citric acid synthesis from potato starch. This study presents raw potato starch as a good substrate for the production of commercially valuable organic acid.

Keyword: sweetpotato, starch, citric acid

TH4ABS069

Sweetpotato-mango leather – an alternative healthy snack

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Abstract
The highly perishable nature of mangoes and sweetpotatoes due to high moisture content, results in high postharvest losses in Ghana. Thus, the need to process them into more stable products. Dextrinized sweetpotatoes was therefore added to mangoes to produce fruit leathers. The effect of dextrinized sweetpotatoes on physicochemical and sensory quality of sweetpotato-mango leather was studied. Sweetpotatoes were dextrinized in an oven at different temperatures (150-200 ^{o}C) and time (2, 2.5 and 3.0 h) for optimization using completely randomized design. The amount of dextrins formed and dextrose equivalents were determined. The physico-chemical parameters (pH, acidity, water activity and vitamin C) of the pulp and leathers are reported in this study. Consumer acceptability test was also conducted. The optimal temperature for maximum dextrin of 19.41 was 190-200 ^{o}C. Water activity and pH ranged from 0.61-0.63 and 4.2-4.33 respectively and vitamin C increased with the addition of sweetpotato. The overall acceptability was high (1.58-1.63) but non-significant ($p < 0.05$) with the amount of sweetpotato added. The mouthfeel was disliked slightly (4.06-4.40) by panellists but colour, smell and taste were rated high (1.00-1.97) due to product aesthetic appeal, fruitiness and sweetness. The physico-chemical and sensory values obtained for infra-red dried mango-sweetpotato leather indicate that sweetpotatoes could be a good source binding and “sweetening” agent in fruit leather production without deteriorating quality parameters. The study has shown that dextrinization of sweetpotatoes could be considered as an excellent alternative in food applications like fruit leathers production; thus providing alternative products for health conscious consumers.

Keywords: dextrinization, mango, physico-chemical, postharvest, sensory, sweetpotatoes

TH4ABS074

Getting the equation right: engendering sweetpotato value chains in East Africa

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Abstract

Upgrading sweetpotato value chains is constrained by its bulkiness, low shelf life, perception of being a poor man's crop and being predominantly seen as a woman's crop. Commercialization efforts thus require increased involvement of men and youth, without jeopardizing benefits accruing to women. The International Potato Center (CIP) is supporting value chain development of Orange Fleshed Sweetpotato (OFSP) using the Participatory Market Chain Approach (PMCA) in Kenya, Uganda and Tanzania. However, while the PMCA helps generate commercial, technological and institutional innovations, it does not explicitly address equitable participation and utilization of benefits by the different gender categories. To address this gap, the authors undertook a 9 month gender coaching trajectory organized by Agri Pro Focus (APF) with an aim of engendering the PMCA. During the coaching sessions, a critical analysis of the PMCA was done which resulted into development of a gender action plan. The plan emphasized gender specific interventions using three strategies: (i) **mitigating resistance by building on tradition** i.e. transforming women's roles from reproductive to productive (subsistence to commercial farming) (ii) **capacity building** (business literacy, sensitizing men, gender responsive financial services) and (iii) **gender responsive businesses** (OFSP businesses becoming a better option for women, men and youth). Support was availed in using suitable gender responsive tools to engender the three phases of the PMCA, and also in tracking the resultant changes. CIP staff in turn coached the country-core teams to employ the tools and strategies. The paper presents findings from the application of gender tools to identify, analyse and prioritize gender based constraints as well as market opportunities in sweetpotato value chains in the three countries. It explores how this analysis has been used by country partners in deciding how to up-grade the value chain in their context. It is too early to assess whether the resultant innovations and benefits will be accessed equitably by women, men and youth. However, the paper concludes with a discussion around: what tools are more appropriate for supporting an engendered approach to value chain up-grading; how the PMCA methodology might be strengthened through the use of these tools; and lastly some of the operational issues which might arise through using an engendered approach for value chain work

TH4ABS103

Possible uses of leaves of exotic sweetpotato genotypes in local nigerian food preparations

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Abstract
Ten recently acquired foreign sweetpotato genotypes in Nigeria (undergoing adaptation trials by National Root Crops Research Institute, Nigeria) were assessed for the possible culinary and nutritional uses of their leaves in Nigerian local food preparation. Leaves of leafy elite sweetpotato genotypes existing in Nigeria were used as experimental checks. Prior to the assessment of the organoleptic properties of the boiled experimental leaves by a food sensory panel, the fresh experimental leaves were botanically characterized. A sensory panel was used to conduct the sensory evaluation of the boiled leaves. The 20 member sensory panelists used a nine point Hedonic scale (where 9= like extremely; 5= neither like nor dislike; 1= dislike extremely) to evaluate the appearance, taste and general acceptability of the boiled leaves. The panelists also commented on the possible uses of the leaves as substitutes or replacements for conventional local vegetables in Nigeria. Relevant biochemical/phytochemical analyses were also carried out on the experimental leaves. The result of their leaves external morphology characterization showed that about 25% were of simple palmate shape while the rest were simple non-palmate. The sensory panelists observed that the leaves from some of the experimental genotypes including local and International checks (Ex-Igbariam, TIS2532.OP.1.13 and TIS8164 respectively) could be used to replace or substitute some indigenous vegetables in local food preparation. The leaves of TIS8164 can also be used for traditional packaging in the preparation of *Ekpan-nkwukwo* (a local Nigerian dish). The nice aroma of the exotic Julian leaves could serve as a potential replacement for some indigenous spices in local food preparations. The chemical analysis carried out revealed that the leaves had high fibre, high chlorophyll and high flavonoids content. The protein content ranged from moderate to high while the total carotenoids content were moderately high. All these show that these experimental edible leaves are good sources of nutrients for certain food security requirements.
Key words: Sweetpotato, edible, leaves, sensory evaluation, phytochemicals, nutrients.

TH4ABS118

Acceptance and promotion of ofsp in ghana: challenges and the way forward

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The Orange fleshed sweetpotato (OFSP) varieties though a secondary and tertiary staple to cassava, yam, plantain, cocoyam etc in developing countries is an tremendous source of provitamin A and can contribute extensively in controlling vitamin A deficiency especially amongst children. This paper seeks to review the introduction, acceptance and promotion of OFSP in the Ghana, its challenges, gaps amongst current and potential stakeholders, identify possible solutions and propose ways of improving the OFSP acceptance amongst the populace through a networked approach and involvement amongst stakeholders.

Key words: OFSP, promotion, vitamin A, stakeholders, challenges

TH4ABS133

Effect of temperature and time regimes on stability of β-amylase activity and sugar profile of sweetpotato roots

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Abstract
To investigate the effect of temperature and time treatments on β-amylase activity and sugars profile of sweetpotato roots, the roots were heated at 65^{o}C, 75^{o}C, and 85^{o}C for 0, 10, 20, and 40min. Sweetpotato genotypes of different sugar contents and β-amylase activities were used for the study. Enzyme assay kits from megazyme and NIRS were employed to evaluate the β-amylase activity and sugar profile of the roots respectively. β-amylase activity generally decreased with increase in temperature and time, and the effect was more pronounced in the low sugar genotypes. β-amylase from high sugar types were faily stable even at temperatures higher than their optimum. The rate of sugar production correlated positively with increase in temperature in almost all the genotypes. The results indicate that β-amylase is more heat stable *in situ* than *in vitro* in high sugar content sweetpotato roots and plays an importance role in convention of starch to sugars.

Key words: β-amylase, sugar profile, stability, temperature.

TH4ABS147

Unlocking the potential of the potato subsector in kenya- a road map for revitalizing the subsector

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Abstract
The potato subsector in Kenya has an unexploited potential which, if properly harnessed, can make significant contributions to Kenya's development aspirations-particularly those related to food and nutrition security and economic development- as articulated in the country's two main policy documents-The Vision 2030 and the Agriculture Sector Development Strategy (ASDS). Despite the investments made into the potato subsector in the last several years, its growth has not been satisfactory. The subsector is currently characterised by: low commercialization, low average yields, poor competitiveness, high wastage, low value addition with limited processing and limited agribusiness activities. There are very few contractual arrangements between producers and end users of potatoes e.g. processors, fast food restaurants or supermarkets. In order to transform the potato subsector from subsistence to a vibrant, commercially oriented subsector, a new roadmap – one which leverages available resources to deliver economic growth and opportunity, improved food security and nutrition, and environmental sustainability is required. This paper presents a road map that provides a guide on the core investment areas necessary to revitalize potato subsector. The roadmap is anchored on three investment areas namely: i) the seed potato value chain ii) the ware potato value chain; and iii) the processed potato value chain. The targets of the roadmap are to increase yields by at least 20% in the next 10 years to achieve three overarching objectives namely: a 15% increase in farm incomes, improved food security and more business opportunities for at least 10% of potato growing households. These growth targets will be achieved through implementation of several flagship projects in each of the priority value chains focussing on several areas including value chain financing, improvement of markets, formulation of favourable policies, adoption of improved farming technologies including irrigated potato farming and promotion of value addition.

Key words: Agriculture Sector Development Strategy, potato subsector, processing potato value chain, Roadmap, seed potato value chain, Vision 2030, ware potato value chain

TH4ABS150

Health and income improvement from OFSP value chain in the Lake Zone

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Abstract
Sweetpotato in most of the Lake zone areas is the main staple food after cassava. The sweetpotato production in the Lake zone is more than 330,600 tons /year and the crop occupies approximately 14 percent of total arable land (Kapinga *et al.,* 1995). Currently it is estimated that 33% of children 6-59 months in Tanzania are vitamin A deficient (TDHS 2010, TDHS Micronutrients 2010). Levels of vitamin A deficiency are highest in drier areas, where the diversity of micronutrient rich foods is lowest. The causal link between compromised vitamin A status and increased child mortality is well-established (Sommer and West 1996). The Dissemination of New Agricultural Technologies for Africa (DONATA) project has been operational in the Lake Zone of Tanzania for four years and the overall objective was to improve livelihoods and increase economic growth for resource poor farmers in East and Central Africa. Under DONATA there has been considerable success in applying an innovation platform and value chain approach to scaling out Orange Fleshed Sweetpotato (OFSP) technologies. A number of successes have been observed including the development of a sweetpotato seed system to ensure the timely availability of adequate quantities of clean planting material. Communities have been sensitized on the nutritional value of OFSP based products, improved food security and income benefits of growing and consuming OFSP by all family members but in particular young children and mothers. Training in the utilization and processing of OFSP into a diverse range of baked, snack and juice products and establishing market linkages and establishment of processing unit. Members of the innovation platforms in Sengerema, Ukerewe, Missungwi and Bukoba rural districts in the lake Zone have benefited from the project in many ways. It is recommended that the approach be extended in other areas in the country to benefit wide range of poor resource farmers.

Key words: OFSP, Health, Income, Dissemination, Value chain

TH4ABS216

Review of sweetpotato marketing initiatives of innovation platforms in east and central Africa

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Abstract

Marketing of sweetpotatoes in East and Central Africa (ECA) is largely informal, ad hoc and disorganized. Farmers try to sell their commodities with minimal benefit. Other chain actors are equally frustrated by unreliable supply, poor infrastructure, high bulking costs, and quality adulteration. Yet markets offer an opportunity for commercializing agriculture and hence improving the livelihoods of smallholder farmers. The Dissemination of New Technologies in Africa (DONATA) was a five year project that sought to accelerate innovations and promote commercialization of the Orange-fleshed Sweetpotato (OFSP). The project used a multi-stakeholder approach through which 21 Innovation Platforms for Technology Adoption (IPTAs) were formed in Ethiopia, Kenya Rwanda, Tanzania and Uganda. The IPTAs initially focused on addressing constraints in the sweetpotato seed systems and later shifted their focus to issues related to root production and processing. However, the IPTAs faced a number of challenges in ensuring remunerable markets for the OFSP stakeholders. CIP undertook a study to identify sweetpotato marketing challenges so as to come up with strategies to improve marketing. Participatory action research was done using key informant interviews, workshops with traders, farmers and IPTA members; and focus group discussions; for 185 respondents. Characterization of the three major chains (seed, roots and processed products) was also done. Results highlighted challenges like dependence on institutional buyers, low willingness to pay and high maintenance costs in the seed chain. Root producers faced low demand for fresh roots and inability to consistently supply identified markets, while processors could not sustain demand due to inconsistent availability and quality of roots, certification of products and low processing capacity. Strategies identified to counter the challenges included market surveys, linkages to credit for machinery, and tools, registration of companies, use of production and marketing plans. Other initiatives included formation of production clusters for collective marketing; inter IPTA linkages for improved supply, and increasing scale of production through supporting emerging entrepreneurs. This resulted in increased ability to forecast and meet demand as envisaged by large scale entrepreneurs in Kenya, Rwanda, and Uganda. In Tanzania, a new factory for processing OFSP flour was commissioned that should spur production of roots and vines. Future interventions should focus on creation of awareness and demand in tandem with stronger and flexible plans to satisfy consumers.

TH4ABS202

Innovations in low-cost, passive, post-harvest potato storage Facilities

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Abstract
In the summer of 2010, Studio [Re], Montana State University and WHEAT foundation worked in partnership to design an affordable, small-scale, passively cooled, post-harvest potato storage facility that could be built for small-scale farmers in Central Kenya to allow them to store their crops for six to eight weeks before selling, thus avoiding rock-bottom market prices at the time of harvest. During 2010 and 2011, two prototype structures have been completed to test design strategies and collect data on cost of construction, effectiveness of insulation strategies through the monitoring of temperature and humidity levels, and ease of use by farmers. Through this testing, surveys of farmers and research of market demand we have concluded that our straw-bale insulated potato storage facilities meet and exceed the intended design objectives and, if adopted, could significantly improve post-harvest income for subsistence farmers in Kenya and elsewhere. Considering the large potential for improving post-harvest crop management, we would like to share our findings and unique new design and construction method with the attendees of the APA conference to encourage technology transfer and better crop management for African farmers.

TH4ABS242

Economic Analysis of Greening of Potatoes in Kenya: Implications for Food Security and Nutrition Policy

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Abstract
In Kenya, about 51% of the population lacks access to adequate food. This is closely linked to poverty which stands at 46% or less than $2 per day. This huge gap in access to food means that consumers in Kenya are more concerned with obtaining adequate food supplies and ensuring food security than they are with food safety or nutrition security. Paradoxically, their food is frequently contaminated with biological and chemical agents that have adverse effects on health. Irish potato is the second most important staple food crop in Kenya. They are an everyday food, something that one buys automatically, without thinking about doing so. However, production meets only 59% of national Irish potato requirement. The population is unaware that poor potato production and handling procedures can lead to the production of poisonous produce. Green potatoes contain a glycoalkaloid poison, solanine, found in the deadly nightshade family of plants to which potato belong. Solanine poisoning

affects humans in various ways, causing diarrhoea, nausea, vomiting, stomach cramps, headaches, hallucinations and a burning throat. In quantity, 3-6 milligrams per kilogram body weight, solanine can cause death in humans. It is estimated that between 14 and 17% of the U.S. potato crop is lost annually due to greening of tubers. In Kenya, modest estimate of the potential loss due to greening could be between 35 and 50% of the total crop. While green potatoes are sometimes culled from retail displays, the process is subjective and variable, due to the absence of specific grading criteria. Indeed much of the potato produce in Kenya not be approved for distribution if they were subjected to the standards that are applied elsewhere on acceptable levels of glycoalcaloids. Potatoes containing amounts greater than 1mg/100g are considered unsuitable for human consumption.Exposing potatoes to heat and sunlight, as is routinely done through roadside marketing, causes the natural poison to concentrate in the exposed areas. This analysis indicates losses of economic importance and dire consequences on food and nutrition due to alkaloids in Kenya. Policy action to stem this problem includes development of greening scales, based on objective measurements of chlorophyll and colour, as an aid to maintain a standard level of quality in wholesale and retail outlets. Laws should be amended to ensure proper storage and marketing of potatoes.

Key words: Potato greening, glycoalkaloids, Marketing, Food Security, Policy Implications.

Theme Five

New evidence concerning nutritional value and changing behaviours

TH5ABS125

Assessing production constraints and farmer preference for sweetpotato through a PRA study and structured survey

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Abstract
A Participatory Rural Appraisal (PRA) was carried out in the Volta, Central and Upper East regions of Ghana to identify farmers' production constraints and preferences for sweetpotato varieties. Altogether, 647 farmers in 27 farming communities were involved in focus group discussions. During these discussions, farmers' production constraints, preferences regarding eating quality and agronomic traits were identified. A total of 120 structured questionnaires were administered in each region to complement information gathered during PRA study. Drought ranked highest among the production constraints identified. With regards to eating quality, farmers preferred varieties with high poundability, low sugar and high dry matter. In all 27 farming communities visited, farmers indicated that the high level of sugar in the sweetpotato was a limiting factor to its frequent utilization and expressed their willingness to accept low sugar varieties for regular consumption. In addition, farmers were of the view that high dry matter and poundable types would increase suitability of the crop in local cuisines. High yielding, drought and pest resistance ranked highest in terms of preferred agronomic traits. These constraints and farmer preferred quality attributes should be considered when developing sweetpotato research goals for Ghana.

TH5ABS030

Behavlour Change In the Development and Buslness World Potential for cross-sectorlal learning on the basis of a nutrition project in Ethiopia

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Abstract
Behavioral change strategies are widely used in promoting the production and consumption of agricultural products such as potatoes and orange fleshed sweetpotatoes (OFSP). These strategies are mainly grounded on the health-belief model and trans-theoretical models. In the business world, behavioural change is important to realign enterprises and their staff to changing business environments. However, the effectiveness and the sustainability of changes occurring as a result of behavioural change strategies is limited in both sectors. Research shows that 70% of all change procedures in the business world fail to bring the expected results. Evaluation reports of Development projects hardly give a better picture. The aim of this study was to compare the most widely used industrial and development behaviour change tools to identify effective strategies and to assess potential for cross-sectorial learning. Experiences made with an Irish Aid funded nutrition project in Ethiopia are

compared with the 8 steps model developed by J.P Kotter (Harvard Business School). The findings indicate that successful and sustainable behavioural change ismore likely to occur if: (a) a “Change Guiding Team” is selected from members of the target group and stakeholders. These teams need to be carefully selected and should include respected opinion leaders who identify with the proposed changes. This team facilitates the change process and provides a two-way feed to the target group and the change managers. (b) “a sense of urgency” is instilled in the target group. For development projects this implies the need to explain very clearly the consequences of not changing (e.g. the effect of vitamin A deficiency on poor mental and physical health of children). (c) changes are introduced one-step at a time (e.g. only 1 additional food item is incorporated into a traditional diet). (d) specific mechanisms are incorporated into the change process to ensure that the changes are sustainable (e.g. by ensuring a regular supply with OFSP roots); development projects are more experienced in doing so than most businesses. The findings indicate substantial potential for cross-sectorial learningthat could be exploited for improving the effectiveness of behavioural change strategies in the development and business world. First findings indicate that the building of the Guiding Team for a Development Project is also influenced by politics and the members are selected according to their function (e.g. government bodies, community groups) rather than the actual commitment of the team members to the proposed change. This can have an impact on reaching the goal of the proposed change and hamper the success, if team members do not show the commitment needed for the proposed change. Secondly first evaluations of the impact of the project show, that the project is successful with its communication strategy and that the cooking demonstration with Orange Fleshed Sweat Potatoes, which is tangible and touches the senses, so far was the most successful and sustainable promotional activity, followed by radio message , billboards and posters.

TH5ABS040

Consumption of vitamin A rich foods and development of maize based orange – Fleshed sweetpotato flat bread for lactating mothers at hawassa zuria district, South Ethiopia

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Abstract
The aim of this study was to investigate the consumption of vitamin A rich foods by lactating mothers and to improve the vitamin A contents of the staple maize-based flat breads. A total of 565 lactating mothers were interviewed to assess the consumption of vitamin A rich foods and the awareness on vitamin A rich foods by using a two stage cluster sampling method. Besides, the survey was used to assess and select the most common staple food of lactating mothers in the study area for incorporating OFSP. To improve the vitamin A content of traditional (staple) flat bread prepared from maize, three formulations of maize-based breads were prepared by incorporating OFSP flour at 25%, 30% and 35%. Traditional maize-based flat bread served as a control. Sensory evaluation was carried-out using a 9-point hedonic rating scale by panelists at the laboratory level. At community level sensory evaluation (acceptability trial) was done by lactating mothers using a 5- point hedonic rating scale. The proximate composition values of flours and the four flat bread samples were determined using AOAC (2000) methods and open column chromatography method was used to determine the values of β-carotene. The majority (63.9%) of the lactating mothers consumed vitamin A rich foods 3 times or more in the past 7 days preceding the survey. Flat

bread prepared from maize was mentioned as their main staple food by 88.14% of the lactating mothers. All the formulations were accepted both at laboratory and community levels. The proximate composition results showed an increase in the values of crude fiber and ash for OFSP incorporated flat breads compared to the control. The vitamin A contents (µg RAE) of maize and OFSP flours were found to be 0 and 888.01µg RAE per 100 gm respectively. Among the flat breads samples in which OFSP flour was incorporated, the vitamin A contents were 175.8,197.22 and 269.63 µg RAE for 25%, 30% and 35% orange fleshed sweetpotato flour supplemented flat bread samples, respectively. OFSP flour up till 35% can be successfully incorporated in traditional maize based flat bread which can be used as a potential food source of vitamin A for lactating mothers residing in the study area.

TH5ABS042

Consumption of vitamin A rich foods by children aged 6-23 months and formulation of maize – based complementary porridge using orange - fleshed sweetpotato flour and bean in Kachabira district, Southern Ethiopia

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Abstract
The aim of this study was to investigate the consumption of vitamin A rich foods by children aged 6-23 months and to improve the vitamin A content of the staple maize-based complementary porridge.The study had two sections: community – based cross-sectional survey and experimental study part. For the former, a two-stage cluster sampling was employed to select 636 children aged 6-23 months from six clusters in Kachabira District, South Ethiopia. The survey had two specific objectives: assessing the consumption of vitamin A rich foods by children and gathering information on local staple complementary food types to be selected for enrichment in the second section of the study. The second section comprised formulation ofthree maize-based (*Zea mays L.)* complementary porridges using flours of haricot bean (*Phaseolus vulgaris*) and OFSP (*Ipomoea batatasL.).* The maize grains were soaked overnight and roasted sparingly, the beans were soaked overnight and roasted for 15 minutes and fresh OFSP roots were sliced and sundried to produce chips.The control complementary porridge was prepared from 100% raw maize flour. The proportions (%) of maize (processed): bean: OFSP flours were 50:25:25, 45:25:30 and 40:25:35 for the three formulated porridges. Sensory evaluation was done at laboratory level and at community level. Complementary porridges were analyzed for proximate composition, β-carotene, zinc and phytate contents using standard methods. Viscosity values (cp) were determined at 20% (w/v) dry matter concentration using a Brookfield (Model DVI+) viscometer.Survey results revealed that consumption of vitamin A rich foods by children in the study area was low (28.8%). Porridge prepared from maize was mentioned to be a staple complementary food by 92.61% of caretakers. All formulated porridges were organoleptically accepted. On fresh weight basis, the complementary porridges in which OFSP was incorporated provided significantly ($p<0.05$) higher vitamin A (30.45 µg RAE/ - 85.52 µg RAE per 100 Kcal) than the control which provided 0.00 µg RAE per100 Kcal. The formulated porridges were also observed to have significantly ($p<0.05$) higher values of crude protein, but significantly ($p<0.05$) lower values of phytate and viscosity compared to the control. Considering a 400µg RE/day DRI of vitamin A for children aged 6-23 months, a 100g serving of porridge in which OFSP flour was incorporated at 25%, 30% and 35% would provide 6.45 %, 15.05 % and 17.85% of the DRI, respectively. To meet the recommended daily 5g of protein that a complementary food should provide for a child aged 12-23 months

with average breast milk intake, 56.05g-59.81g, dry weight basis, of the formulated porridges would be needed. Incorporating flour of OFSP and haricot beans in maize flour is a potential way to increase the nutritive value of traditional complementary foods prepared from maize in the study area.

TH5ABS091

Determining available nutrients in sweetpotato using *in-vitro*digestibility and in sacco degradability in the highlands of Kenya

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Abstract
Six sweetpotatoes cultivars namely; Naspot1, 103001, Kemb23, Gweri, Kemb36 and Wagabolige were grown in three agro-ecological locations, Nyeri County (High altitude), Nandi County (Medium altitude), and in Bomet County (Low altitude) within the highlands of Kenya. The principal factors related to sweetpotato's protein and energy digestibility are protein and dry matter content, trypsin inhibitor activity, and starch digestibility. Considerable variation exists in intestinal digestion of protein among and within different protein sources, and this variation can possibly be influenced by the area where the forage was grown, the nutrient content and various other factors. The high degradability of sweetpotato suggests that it can be good protein forage and accumulation of this type of information will ensure that protein supplements are allocated on the basis of their flow rate from the rumen with a given type of diet. The digestibility and rumen *in vivo* (in-sacco) degradation are some of the major tools used in assessing the value of a feed because they give an indication of the proportion of the feed that is digested and therefore available for absorption.Samples of storage roots and vines of the six sweetpotato cultivars were oven dried, milled to pass 3 mm screen and pooled and a subsample of 3.0 g was taken for digestibility analysis and *in vivo* degradation determination. General Liner Model in a three way factorial arrangement of SAS (2003) was used to compute analyses of variance (ANOVA) to test for any significant differences *in vitro* digestibility; while, GLM in Complete Randomized Design (CRD) of SAS (2003) was used to compute ANOVA to test for any the same on *in-vivo* degradability.There was significant difference in vine and storage roots *in vitro* CP digestibility (IVCPD) due to variation in locations ($P<0.05$), cultivars ($P<0.05$) and management ($P<0.05$). There was also significant interaction between management and cultivars ($P<0.05$) in both. Gweri ratooned at day-75 in Bomet (low) and had the highest IVCPD while N. Nandi (medium) was the location with the highest IVCPD. *In vivo* degradation characteristics of vines and storage roots of various sweetpotato cultivars indicated that there was difference in solubility or washing loss ($P<0.05$) and degradation potential ($P<0.05$) of both in various cultivars.The high degradability and degradation of sweetpotato suggests that it can be good protein and energy forage.

Keywords: Sacco degradability, *in vivo digestibility, General Liner Model*

TH5ABS165

Effect of sweetpotato meal and composite sweetpotato meal based diets on performance on weaner rabbits

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Abstract
An experiment was conducted to evaluate the effect of sweetpotato and its composite mealbased-diets on the biological performance and bio-economics of production of weaner rabbits. Thirty weaner rabbits averaging 0.35kg were randomly allotted to 5 treatment groups in a completely randomized design. Each treatment group was replicated 3 times. Sweetpotato meal and composite sweetpotato meal replaced maize at 20% inclusion level. Treatments 1, 2, 3, 4, and 5 contained the control, sundried sweetpotato meal (SSPM), Boiled sweetpotato meal (BSPM), composite sundried sweetpotato meal (CSSPM), and composite boiled sweetpotato meal (CBSPM) respectively at 20% levels of inclusion. The weaner rabbits were fed *ad-libitum* throughout the experimental period. Significant differences were observed for growth performance of the rabbits in average daily weight gain, average daily feed intake and feed conversion ratio in the weaner rabbits using sweetpotato and composite sweetpotato meal based-diets. The values of mean daily weight gain ranged from 16.09g in treatment 3 (BSPM) to 18.47g in treatment 1 (control). The values of average daily feed intake also ranges from 42g in treatment 3 (BSPM) to 50g in treatment 1 (control).Moreover, the values of feed conversion ratio (FCR) ranged from 2.47 in treatment 5 (CBSPM) to 2.70 in treatment 1 (control). Significant differences ($P<0.05$) were also observed in bio-economics of production of weaner rabbits using composite sweetpotato meals. The cost per kg feed, cost of total feed consumed per rabbit and cost per kg weight gain of the rabbits fed the test diets were significantly lower than the control diet. For revenue, no significant difference was observed among the treatments. For gross margin, CSSPM and CBSPM were the same but significantly higher than the control. It was concluded that using sweetpotato and composite sweetpotato meal can be a good feeding method in rabbit production.

TH5ABS143

Introduction of nutrient dense sweetpotatoes in Zambia: working with farmers on-farm

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Abstract
The Sweetpotato Breeding Program in Zambia has been for the past few years engaged in introgressing high β-carotene genes in white fleshed high dry matter sweetpotato varieties that are preferred by consumers. Through this process five varieties were identified for on-farm testing and introduction to farmers in the 2011/2012 season. The objectives were to

introduce the varieties to farmers, to test the performance of top orange fleshed sweetpotato varieties under farmer growing conditions and researcher-farmer management, to test farmers' acceptance and ranked preference of the varieties for yield and quality attributes (with taste tests), to obtain feedback (farmer preference) to breeders for standardizing of methods and to build farmers' capacity on variety assessment. The methodology involved partner identification and field selection, identification of farmers/farmer groups, planning for the variety trial with farmers, planting the trial, field assessment and monitoring, Agronomic and taste evaluations for SPVD assessment and weeding, leaf taste-test evaluation and root taste-test (quantitative and participatory) evaluation. The varieties planted were Olympia, Kokota, Twatasha, Orange Chingovwa and Zambezi. These were planted in plots of 5 x 6 m ridges per variety spaced at 1 m and each farm served as a replication. Eighty one farmers participated in leaf evaluations for vegetable among which were 38 female farmers. Variety Chingovwa and Orange Chingovwa were the most preferred for vegetable across the testing sites after boiling. Root taste evaluation involved 114 participants among which were 69 females. Variety Olympia and Chingovwa were preferred before cooking and Chingovwa and Orange Chingovwa after boiling. Mean root fresh yields ranged from 7.3tha^{-1} for variety Zambezi to 9.6tha^{-1} for Chingovwa. Experience from this activity has shown that clear protocol interpretation by partners and researchers is indispensable. Farmer selection and field location is critical. Field selection by farmers occurs in July-September and the location must facilitate regular monitoring especially of disinterested farmers. Simplification of data collection to facilitate farmer participation is required. There is need to further develop the on-farm standard protocol to include challenges of vine re-establishment/replanting and cooking methodology that was different for each district. Overall, each variety was preferred either for roots or vegetable or both.

Keywords: participation, farmer, vegetable, orange flesh, sweetpotato

TH5ABS220

Micronutrient Deficiency Reduced in Kenya using Sweetpotato Forage as a Vegetable

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Abstract
Micronutrient malnourishment among Kenya citizens diminishes human potential and national economic development. It causes learning disability among children, increases morbidity and mortality, lowers worker productivity and increases healthcare costs. The objectives of the study were to evaluate six forage sweetpotato cultivars on their micronutrient composition and their potential when offered as a vegetable to meet calcium (Ca), magnesium (Mg), iron (Fe) and zinc (Zn) requirements of children aged 4 to 6 years. The cultivars 99/1, K049, K158, Marooko, Mugande and Wagabolige were laid out in randomized complete block design with three replicates. They were established using cuttings in rows 60 cm wide and 30 cm apart. Fertilizer was applied at planting at 54 and 20 kg/ha of nitrogen (N) and phosphorus (P) respectively and top dressed with 52 kg/ha N. They were harvested at 120 days, sampled and analysed for Ca, Mg, Fe and Zn. The data was analysed using general linear model of SAS and means separated using least significant difference procedures. Cultivars 99/1, K049, K158, Marooko, Mugande and

Wagabolige contained 6.10, 4.80, 7.68, 8.41, 4.40 and 5.49; 4.78, 2.90, 5.15, 3.20, 3.92 and 5.36 g/kg DM; 388.0, 230.0, 326.3, 286.7, 278.0 and 317.7 and 178.7, 184.0, 180.7, 179.7, 136.3 and 177.3 mg/kg DM Ca, Mg, Fe and Zn respectively. Hence using the WHO/FAO (2005) recommended nutrient intakes (RNI) the children aged 4 to 6 years will eat the respective cultivar vegetable weighing 98.4, 125.6, 78.4, 71.1, 136.5 and 109.3; 15.9, 26.2, 14.8, 23.8, 19.4 and 14.2; 32.5, 54.8, 38.6, 44.0, 45.3 and 39.7 and 53.7, 52.2, 53.2, 53.4, 70.4 and 54.1 g DM to meet their RNI of Ca, Mg, Fe and Zn respectively. Cultivars 99/1, K158, Marooko and Wagabolige contained relatively high micronutrients while K049 and Mugande contained less. In fact Marooko, Wagabolige and 99/1 contained the highest Ca, Mg and Fe respectively while K049 and K158 contained equally high Zn. According to this study, once the quantity of vegetable attains RNI for Ca, the other micronutrients RNI are met too. The quantity of daily vegetable required per child is relatively little, most farming communities can grow the vegetables and those in urban centres can cheaply purchase the vegetable. These cultivars should, therefore, be grown and widely fed to children aged 4 to 6 years as a vegetable to reduce micronutrient deficiency in Kenya.

TH5ABS036

Mobile kitchens for improved nutrition: evidence from a behavior change intervention to introduce orange-fleshed sweetpotato in tigray, Ethiopia.

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Abstract

The primary objective of the research was to assess whether mobile kitchens are an effective tool to increase consumption of Orange-fleshed Sweetpotato (OFSP) as a nutritious food in Tigray, Ethiopia, where sweetpotato was previously not consumed. The investigation covered interventions in 7 communities involving 7,700 households from 2010 to 2012. A participatory action research approach was chosen to assess cost-effectiveness and adoption rates of OFSP promotion in new communities using community women development groups as the primary extension agents. The main findings include that 6,000 households were reached at an average cost of US$ 1.75 per household leading to the adoption of improved nutrition behavior among 5,000households of the population in the targeted communities. This evidence indicates that mobile kitchens are an effective tool for reaching large numbers of remote rural populations at relatively low cost in a short period of time. Secondly, it suggests that mobile kitchens are effective for inducing nutrition behavior change among these target groups including adoption of new crops such as OFSP in daily diets.

TH5ABS078

The role of sweetpotatoes (*Ipomoea batata,* Mill) in the food system of urban and peri-urban of Arusha City, Tanzania

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Abstract
Urban and peri-urban sweetpotato production is widely practiced in Tanzania. This study was conducted in April to June 2012. The purpose of this study was to empirically examine the impact and extent of sweetpotato production, its role in the food system, income generation and constraints. The study used data collection from Arusha City and its peri-urban areas from a purposively selected sample of 250 households. Descriptive statistics are used to examine the impact of sweetpotato growing in the food system measured in calories (Kcals). Determinants of household's income generated from sweetpotato are analyzed using a two stage least square regression. Results indicate the area varies from less than 0.25 acres to 5.9 acres, and the crop is grown by male and female farmers. Mean calorie available from sweetpotato consumption is 2361.45 Kcals. Regression results show significant positive relationships between income generation from the sale of fresh storage roots, leaves/vines, area (acreage) and experience of the farmer. Education and gender are negatively associated with income. Farmers sale fresh storage roots, leaves and vines directly to consumers or middlemen or women vendors. Dominant varieties include "Tengeru Red", "Noveto (CIP 4400131)" and narrow leafed ones known as "Matembele". No orange fleshed varieties were found to be grown. Some of the constraints for increased production include: limited land due to competition with infrastructure developers, drought and varieties. These outcomes suggest the importance of promoting sweetpotato growing as one way to improve food security and supplemental income in Arusha City.

Key words: sweetpotatoes, urban, peri-urban, Tanzania, Arusha

TH5ABS076

Total carotenoid and lycopene content in some potato (*Solanum tuberosum* L.) clones under selection in Tunisia

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Abstract
Potato (*Solanum tuberosum* L.) is an important staple food of the human diet. Bioactive compounds with antioxidant potential contained in potato tubers are constantly attracting more research attention. In this study, the variability in total carotenoid and lycopene content of 4 potato clones with different skin and flesh colour were investigated (V1R: medium yield, red skin, yellow flesh and high dry matter content; V2Y: high yield, yellow skin, yellow flesh and high dry matter content; V3Y: high yield yellow skin, white flesh and medium dry matter content; V4P: high yield, purple skin, yellow flesh and high dry matter content). The determination of the total carotenoid and lycopene content was performed spectrophotometrically at 450 nm and 503 nm respectively on potato flesh. The result showed, for the first time in potato, the presence of different levels of lycopene (the pigment responsible for red colour) mainly in the red skin potato clone V1R. Significant differences were found in total carotenoid and lycopene content between the studied potato clones. Total carotenoid varied from 14.71 µg/100 g FW in V4Y to 132.59 µg/100 g FW in V1R. Lycopene content varied from 7.33 µg/100 g FW in V1I to 25.83 µg/100 g FW in the red skin clone V1R. This preliminary result demonstrates that potato tubers contain valuable antioxidant compounds and stress the need to evaluate such variability in different potato cultivars. This step may contribute to improve potato antioxidant content and create a possible marketing label for potato.

Key words: potato, carotenoid, lycopene

TH5ABS082

Carbohydrate composition, viscosity, solubility and sensory acceptance of sweetpotato- and maize-based complementary foods

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Abstract
Cereal-based complementary foods from non-malted ingredients form a relatively high viscous porridge. Therefore, excessive dilution, usually with water, is required to reduce the viscosity to be appropriate for infant feeding. The dilution invariably leads to *"energy and nutrient thinning"*, that is, the reduction of energy and nutrient densities. Carbohydrate is the major constituent of food that significantly influences viscosity when heated in water. The objectives of this study were to compare the sweetpotato-based complementary foods (extrusion-cooked ComFa, roller-dried ComFa and oven-toasted ComFa) and enriched Weanimix (maize-based formulation) regarding their: (*a*) carbohydrate composition; (*b*) viscosity and water solubility index (WSI); and (*c*) sensory acceptance evaluated by sub-Sahara African women as model caregivers. The level of simple sugars/carbohydrates was analysed by spectrophotometry, total dietary fibre by enzymatic-gravimetric method, and total carbohydrate and starch levels estimated by calculation. A Rapid Visco™ Analyser was used to measure viscosity. WSI was determined gravimetrically. A consumer sensory evaluation was used to evaluate the product acceptance of the roller-dried ComFa, oven-toasted ComFa and enriched Weanimix. The sweetpotato-based complementary foods were, on average, significantly higher in maltose (26 times) sucrose (5 times), free glucose (19 times) and fructose (7 times), and total dietary fibre (8-11 *vs.* 6 g/100 g), but were markedly lower in starch (10-13 *vs.* 47 g/100 g) content compared with the levels in the enriched Weanimix.Consequently, the sweetpotato-based complementary foods had relatively lowapparent viscosities: 9-, 13- and 20-times lower at the peak, *"consume"* and final viscosities; and high WSI (6.6 times)compared with that of enriched Weanimix. The scores of sensory liking given by the caregivers, on a 9-point hedonic scale, were highest for the roller-dried ComFa (7.5 – 8.3), followed by the oven-toasted ComFa (5.8 – 7.5), and lastly, the enriched Weanimix (5.8 – 6.5). The sweetpotato-based formulations have significant advantages as complementary food due to the high level of endogenous sugars and low starch content that reduced the viscosity, increased the solubility and imparted desirable sensory characteristics, and potentially avoiding excessive *"energy and nutrient thinning"*.

Keywords: *Carbohydrate; Complementary/infant food; Sensory; Simple sugars; Sweetpotato; Viscosity*

TH5ABS160

Effect of chemical fertilizer application on sweetpotato yield, eating qualities and its economic implications in Malawi

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Key words: Sweetpotato, tuber yield, eating qualities, economic implications

Abstract
A trial was conducted for three seasons (2007 to 2009) at Chitedze (31° 59' S; 33° 38' E), Chitala (13° 40' S; 34° 15' E) and Makoka (15° 32' S; 35° 11' E) research stations in Malawi to evaluate the effect of N, P and K fertilizer application on sweetpotato (*Ipomoea batatas* [L] Lam) tuber yield, eating qualities and its economic implications. Treatments comprised nitrogen (0, 30 and 60 kg /ha), phosphorus (0, 30, 60 kg /ha) and potassium (0, 50 and 100 kg / ha) in a 3x3x3 factorial arrangement in Randomized Complete Blocks with 3 replicates. The soils at Chitedze and Chitala are sandy clay loams with acidic pH (4.5-4.6), medium OM (2.3-3.3 %) and N content (0.12-0.15 %), medium to high K (0.34-0.46 m.e. %) and low to very low P (2.5-17.2 μg /g) content while the soils at Makoka are clay loams with moderate pH (5.4) and low to very low in OM (1.02 %), N (0.05 %), P (8.0 μg /g) and K (me. %) content. Fertilizers were applied within a week of planting using Calcium Ammonium Nitrate (27 % N), Triple Super Phosphate (46 % P_2O_5) and Muriate of Potash (K_2O) as a source of N, P and K, respectively. Fertilizer application did not significantly affect the sweetpotato tuber yield except at Makoka where the yields were significantly ($P \leq 0.001$) increased by 23.0 and 29.7 % with 30 kg N and 60 kg N /ha, respectively. Nonetheless; it is not economically justifiable to apply more than 30 kg N /ha even at this site. Tuber dry matter content (DM) was not affected by fertilizer application except at Makoka where it significantly ($P \leq 0.05$) increased with 60 kg /ha. The eating qualities of the boiled tubers were not affected by fertilizer application in all sites.

TH5ABS132

Influence of the Environment on Sweetpotato End Use Quality Traits in Central Rift Valley of Kenya

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Abstract
Sweetpotato (*Ipomoea batatas* (L.) (Lam) ranks as the world's seventh most important food crop after wheat, rice, maize, potato, barley and cassava. More than 133 million tonnes are produced globally per year. It is high in carbohydrates and vitamin A and can produce more edible energy per hectare per day than wheat, rice or cassava. It has an abundance of uses ranging from consumption of fresh roots or leaves to processing into animal feed, starch, flour, candy and alcohol. Roots from twelve accessions comprising Kenyan breed Hybrids and Open pollinated clones together with four farmer grown controls SPK 013, Mugande,

SPK 004, and Kemb10 were screened for their nutritional and end use quality traits for the contents of beta carotene content, dry matter content and general acceptability (taste test) by using CIP beta carotene catalogue, AACC method and hedonic scale respectively. Trait stability and the effects of the environment on the expression of the nutritional and end use traits were evaluated using genotype (G) by environment (E) interaction study model. There were significant (*p≤0.05*) differences for all the traits in the five test sites of Njoro, Lanet, Lare, Ravine and Kabianga in Kenya Central Rift Valley. Contents of beta carotene in roots, total root dry matter and general acceptability ranged from 0.00 ppm to 14.7 ppm; 15.5 percent to 37.5 percent and bad to very good respectively. The sites were also significantly (*p≤0.05*) different from each other with the highest beta carotene content on roots expressed across sites. Regression analysis was used to assess genotype response to environments. Regression coefficients (*bi*) obtained ranged from around 0.1 to over 2.0 for all traits combined indicating wide variability in quality traits among the test germplasm. This implies that the same sweetpotato genotypes will give food of different quality depending on growing environment. The observed values for beta carotene suggest the potential for improving the nutritive value of sweetpotato germplasm in Kenya.

Keywords: *Sweetpotato, quality, beta carotene, dry matter, general acceptability*

TH5ABS054

Developing the region's sweetpotato Industry through Value Added Product Development

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Abstract
Exploiting the value-added potential of sweetpotato is important for attaining food and nutrition security goals of the Caribbean Region. To promote increased production and consumption of sweetpotato, it is important that the range of products available to consumers be diversified. Product diversification however, requires in part, information on the chemical/nutritional properties of these popular local lines so that the products for which they are best suited can be identified. CARDI, in collaboration with the Regional and International partners, has made efforts to determine the proximate composition and physiochemical properties of some popular regional varieties of sweetpotato, *Ipomoea batatas* L. *Manihot* (carbohydrate, reducing sugars,vitamins, dry matter content, brix) in an attempt to identify their suitability for value added product development. The proximate composition of the cultivars examined was typical of sweetpotato but significant differences exist among cultivars in relation to the DM content and suitability for value added product development. The results of these analyses also revealed that geography, soil type and weather conditions can influence chemical composition of some varieties. More than 50% of the varieties analysed were most suited for flour and <20% for fries and juice. These observations are discussed within the context of expanding the current range of value added products and strengthening value chains for these commodities.

Keywords*: physiochemical properties, proximate composition, sweetpotato cultivars, value added product development*

TH5ABS142

Pumping Iron and Zinc for health from "Irish" potatoes

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Abstract
Micronutrient malnutrition is a serious global affliction that limits the work capacity of people and hinders economic development. Beyond energy and income from farm production, nutritional health depends largely on the outputs that agricultural crops produce. Yet the explicit goal of improving human nutrition and health is relatively new to agricultural institutions and to plant breeding. In the past 5 years, across major food crops, targeted research has shown that breeding for nutritional quality is a viable, practicable and cost-effective strategy to complement existing interventionist strategies to help mitigate micronutrient malnutrition. With support from HarvestPlus, CIP has added biofortification to its mainstream potato breeding goals of enabling sustainable productivity gains through improvements in disease resistance, adaptation and yield stability. Characterization of Andean landrace diversity, improved populations and varieties revealed 4-fold variation in the concentrations of Fe and Zn in potato tubers. Despite significan influence of production conditions and GxE interaction, heritability of the concentrations of Fe, Zn and vitamin C in potato are sufficient to enable further increments through breeding. Realizing genetic gains with a view to sustainable and nutritious production and food systems, has required the development of fast screening methods, new knowledge of potato as a staple and co-staple food, and understanding of new traits and their relationships with protection, productivity and utilization characteristics required for varietal change. First products of potato biofortification are currently under selection on farms in Peru and slated for introduction to Rwanda and Ethiopia from 2013. Potential value-added novelty and processing characteristics including yellow flesh, health-promoting pigments, antioxidant activity and chipping quality encountered in the 4x-2x breeding scheme may help roll out micronutrient-rich potato populations and enhance farm income and dietary diversity.

TH5ABS156

Sharing information and knowledge on appropriate sweetpotato policies for germplasm exchange, food security and trade across groups, communities and organizations in sub Saharan-Africa

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Abstract
Sweetpotato offers great potential for rooting out hunger in sub-Saharan Africa and has potential for feeding humans and animals. Sweetpotato improves nutrition, increases income earning opportunities and empowers women. Access to quality planting materials can improve food security and nutrition and there are many breeding efforts to improve varieties suited to local agro-ecological conditions and great achievements have been attained. Although it is widely grown, especially during dry spells, improved varieties that are rich in vitamin A and other minerals and vitamins have not been fully exploited. Although the average yields are low in Africa, improved and local varieties can produce more than 15

tons/ha. There is a wealth of information and knowledge on orange-fleshed sweetpotato germplasm that needs to be shared across groups, communities, governments and development partners in Africa to mitigate against hunger and malnutrition and to promote trade. The Sweetpotato Knowledge Portal provides a platform where sweetpotato professionals and scientists come together to share content on diverse areas including links to gene banks and sources of information on policies and guidelines on germplasm exchange. The Portal has 236 items on germplasm and breeding, and in the last 3 years, this category of content on the portal has received more than 1000 unique hits by diverse users from over 70 countries including 20 African countries. Considering the wealth on content available on the portal, these figures suggest that the Sweetpotato Knowledge Portal is not fully exploited. A major challenge to knowledge sharing activities is resistance to sharing their knowledge with others. There is a need for a culture of trust and openness to ensure information and knowledge on nutritive sweetpotato gerrmplasm are widely shared and applied for improved food security in Africa.

TH5ABS160

Effect of chemical fertilizer application on sweetpotato yield, eating qualities and its economic implications in Malawi

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Abstract
A trial was conducted for three seasons (2007 to 2009) at Chitedze (31° 59' S; 33° 38' E), Chitala (13° 40' S; 34° 15' E) and Makoka (15° 32' S; 35° 11' E) research stations in Malawi to evaluate the effect of N, P and K fertilizer application on sweetpotato (*Ipomoea batatas* [L] Lam) tuber yield, eating qualities and its economic implications. Treatments comprised nitrogen (0, 30 and 60 kg /ha), phosphorus (0, 30, 60 kg /ha) and potassium (0, 50 and 100 kg / ha) in a 3x3x3 factorial arrangement in Randomized Complete Blocks with 3 replicates. The soils at Chitedze and Chitala are sandy clay loams with acidic pH (4.5-4.6), medium OM (2.3-3.3 %) and N content (0.12-0.15 %), medium to high K (0.34-0.46 m.e. %) and low to very low P (2.5-17.2 μg /g) content while the soils at Makoka are clay loams with moderate pH (5.4) and low to very low in OM (1.02 %), N (0.05 %), P (8.0 μg /g) and K (me. %) content. Fertilizers were applied within a week of planting using Calcium Ammonium Nitrate (27 % N), Triple Super Phosphate (46 % P_2O_5) and Muriate of Potash (K_2O) as a source of N, P and K, respectively. Fertilizer application did not significantly affect the sweetpotato tuber yield except at Makoka where the yields were significantly ($P \leq 0.001$) increased by 23.0 and 29.7 % with 30 kg N and 60 kg N /ha, respectively. Nonetheless; it is not economically justifiable to apply more than 30 kg N /ha even at this site. Tuber dry matter content (DM) was not affected by fertilizer application except at Makoka where it significantly ($P \leq 0.05$) increased with 60 kg /ha. The eating qualities of the boiled tubers were not affected by fertilizer application in all sites.

Key words: Sweetpotato, tuber yield, eating qualities, economic implications

TH5ABS142

Improving food security, nutrition and gender empowerment with orange fleshed sweetpotatoes in Malawi: a beneficiary assessment

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Abstract
A beneficiary assessment was conducted to assess the contribution of orange-fleshed sweetpotato (OFSP) varieties on household food and nutrition security and the extent to which the project has empowered women in economic activities. The study was conducted in Dedza, Zomba, Chikwawa and Phalombe districts in Malawi where CIP in collaboration with partners is implementing the "Rooting out Hunger with Nutritious OFSP" project. The assessment involved Focus Group Discussions (FGDs) with communities who benefitted from OFSP vines through the project's voucher system, these were both OFSP vine multipliers and household beneficiaries and key informant interviews with stakeholders. Participants in FGDs revealed that OFSP varieties, especially Zondeni, have become popular among households due its multiple benefits. OFSP has improved household food availability as the households have now enough maize flour through lunch meal substitution during food lean months. Participants were also articulate on the presence of vitamin A and C in OFSP and its importance. Women participants with school going children have observed that boiled fresh OFSP helped in satisfying children's appetites after school and increased their activeness. Other participants, especially older women, reported an improved eye sight after consuming Zondeni. Furthermore, OFSP has contributed to women empowerment as they are now engaged in selling of food products from OFSP including sweetpotato vines, juice, scones, cakes, fritters and chips. Awareness campaigns on nutrition benefits of OFSP, voucher system, DVMs location and strong partnership accelerated adoption of OFSP. Key informants have noted a shift from overreliance on one food crop, maize, to dietary diversification as household now understands the nutritive value of OFSP. A yield increase was noted to have resulted from injection of clean seed by the project in the target districts. Women participants also reported increased attention from their spouses due to OFSP enterprises and joint decision making on household income. On average farmers are sold fresh roots at 0.16USD. In supermarkets, prices ranged from 1.1 USD to over USD3.5 for white fleshed sweetpotatoes. This gives an indication that there is an untapped market potential for OFSP farmers. The study concludes that OFSP is a strategic food security crop in Malawi which will enhance gender empowerment among rural vulnerable households. Creation of effective market linkages and involvement of private sector will improve commercialization of OFSP in Malawi and consequently improve national food security.

Key words: Beneficiary; Women; Sweetpotato; Seed.

TH5ABS250

Fermentation quality of sweetpotato vine silage at different molasses levels.

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Abstract
High sweetpotato vine quantity during season of production and the absence of the technology for conservation form main constraint to optimum utilization of the forage. Conservation could remove the constraint of feed wastage and availability of crude protein reach roughage for livestock during times of feed scarcity. A laboratory experiment on ensiling sweetpotato vines was carried out to determine the quality of fermentation at different levels of molasses. A completely randomized design was used at molasses levels of 0, 5, 10, 15 and 20% on unwilted vines. Chopped sweetpotato vines weighing 60 kg was used for each molasses treatment level. The silage samples were taken 30 days after ensiling to determine its chemical composition. The dry matter (DM) and crude protein (CP) contents decreased with increasing levels of molasses. from 22.5 for fresh material and decreased to 13.38 for silage without molasses and l2.01, 13.57, 12.48 and 11.10 percent CP for silage with molasses. Neutral detergent fibre (NDF) decreased with increase in molasses rates too. The NDF of silage without molasses decreased slightly to 38.22 compared to 39.72 in the fresh material. There was significant ($P<0.05$) pH value decrease after addition of molasses which did not change among the treatments with various molasses rates. Silage without molasses had a higher pH of 4.5 but ranged from 3.9 to 4.0 for silage with molasses. DM content of sweetpotato vines increased significantly ($P<0.05$) with the addition of molasses. There was no significant ($P>0.05$) change in DM for the silage with different molasses rates which ranged from 179.9 - 188.9g/Kg with golden brown colour and good fruity smell.

Key words: Fermentation, Dry matter (DM), Neutral detergent fibre (NDF).Crude Proteins (CP), pH

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